Types of Filtration

- Manual Screen Changer
- Hydraulic Screen Changer
- Dual or Single Piston
- Continuous Belt/Ribbon Type
- Multi-Segment Rotary Disc
- Large Area - Candle Element

Manual Screen Changer - *Strengths*

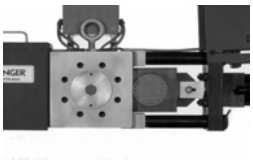
- Sizes: 30 mm to 150 mm
- Low capital costs
- Low operating costs
- Streamlined flow paths
- Minimum residence time
- Small in size

Manual Screen Changers - *Weaknesses*

- Process Interruption
- Line shutdown
- Air entrapment
- Limited open area
- Seal leakage/replacement

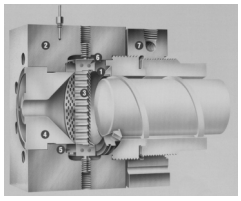
Hydraulic Screen Changer - *Strengths*

- Sizes: 70 mm to 380 mm
- Low operating costs
- Low capital costs
- Streamlined flow paths
- Minimal residence time
- Industry acceptance



Hydraulic Screen Changer - *Weaknesses*

- Process interruptions
- Air entrapment
- Heated standby screen
- Limited open area
- Complicated hydraulics
- Seal leakage/replacement

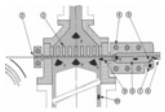


Belt Type Screen Changer - *Strengths*

- Constant differential pressure
- Streamlined flow paths
- Minimal residence time
- Low operator intervention

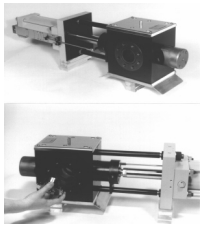
Belt Type Screen Changer - *Weaknesses*

- Limited size ranges
- Capital costs
- Operating costs
- Sophisticated controls
- High contamination
- Temperature dependent sealing
- Head/differential pressure limitation



Piston Screen Changer - *Strengths*

- Sizes: 30 to 450 mm
- Continuous filtration
- Sealless design
- High open area
- Uses round screens
- Low capital & operating costs
- Variety of special applications

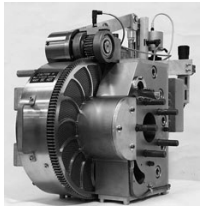


Piston Screen Changer - *Weaknesses*

- Cost relative to hydraulic
- Some pressure variations
- Operator skill level
- Size and installation
- Increased residence time

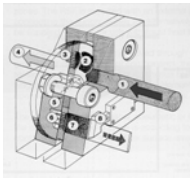
Rotary Screen Changer - *Strengths*

- Sizes: 30 mm to 250 mm
- Very constant pressure
- Streamlined flow paths
- Minimum residence time
- High automation
- Low operator intervention



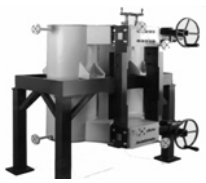
Rotary Screen Changer - *Weaknesses*

- Too loose - leakage
- Too tight - lockup/galling
- High capital cost
- Sophisticated controls
- High differential pressure
- Pressure/viscosity dependent bolt torque



Large Area Filtration - *Strengths*

- Sizes: 5,000 PPH and up
- 5 microns at 90% efficient
- Difficult applications
- Single and dual vessel
- Depth filtration - gels



Large Area Filtration - *Weaknesses*

- Capital cost
- Operating cost
- Safety
- Large installation area

Application Factors

- Required level of filtration
- Screen change frequency/on stream life
- Effect of pressure variation on process
- Frequency of normal line shutdown
- Material waste & downtime during start-up
- Overall process pressures

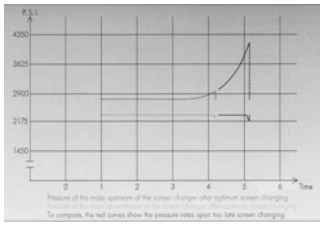
The Piston Screen Changer

- One or two screen pistons in a housing
- 1 or more removable breaker plates
- Tolerances/sealing length resist leaks
- One or more converging flow channels
- At least one screen in flow at all times
- Optional Automatic Positioning System

Continuous Production

- All screens in operating position
- Screen change - move out of polymer flow
- All material flows through second screen
- Each screen/channel sized for total output
- Viscosity decreases, pressure rise minimal
- Avoid excessive pressure before change

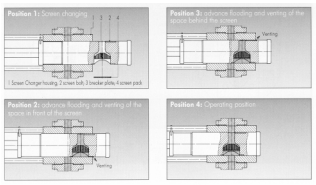
Screen Change - Pressure Rise Over Time



Automated Venting

- Venting grooves - front, back and top
- Complete venting of the screen cavity
- Precise positioning via ultrasonic
- Automatic timing and sequence
- Minimize any loss of die pressure

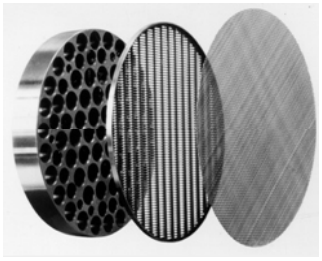
Venting of Screen Cavity



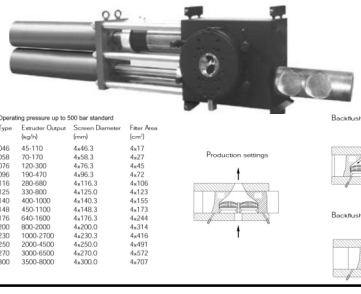
Support Plates/Breaker Plates

- Breaker plate - 56% open area
- Support plate - Up to 98% open area
- Vertical ribs support screens off breaker
- Use large holes in breaker plate
- Low pressure drop, full screen utilization

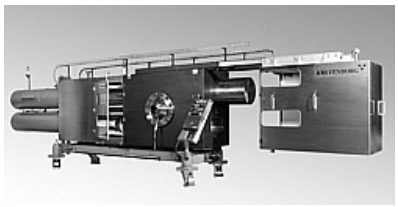
High Open Area Breaker and Support Plate



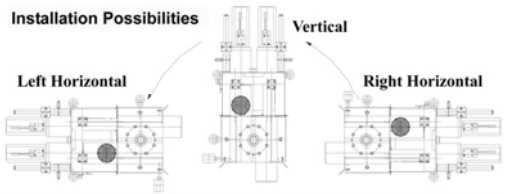
Four Screen - Backflush



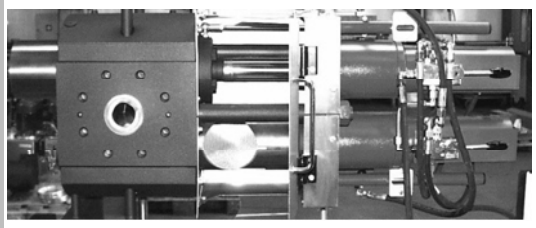
Four Screen – Backflush, cont.



Mounting Configurations



Moving Toward Standardization

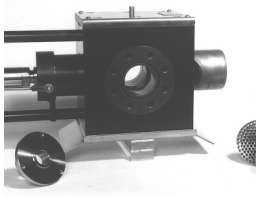


Continuous Piston Applications

- Single piston, continuous
- Dual piston, continuous
- Backflush
- Four screen, dual piston, continuous

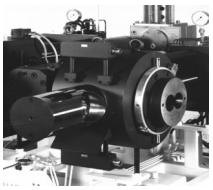
500 PPH, HDPE Strand Pelletizing

- Single piston, (2) 3.0" screens
- Screw pull through
- Lower cost system
- No process interruptions
- Lower total and delta-P
- 250 mesh screens
- No dropped strands at change

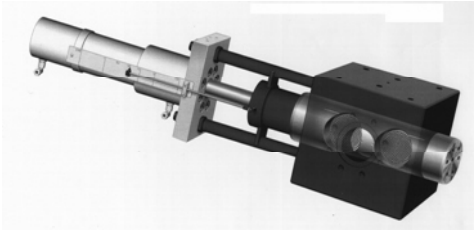


1500 PPH, PS Inline Thermoforming

- Single piston, (2) 6.94" screens
- 6" extruder, w/ gear pump
- Replaced slide plate
- No loss at screen change
- Higher contamination levels
- Finer filtration level
- Less scrap to handle
- 12.5% increase in line productivity



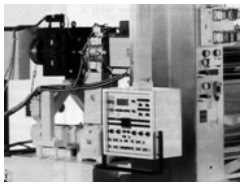
Single piston, two screen, continuous



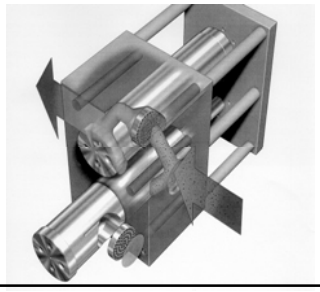
Dual Screen

3,000 PPH Inline Sheet Thermoforming

- Dual piston, (2) 6.94" screens
- Two piece food container
- HIPS bottom/PET top
- Replace slide plate
- Increase line production
- Increase filtration to 150 mesh
- Lower pressure/longer screen life

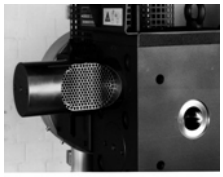


Dual piston, two screen, continuous

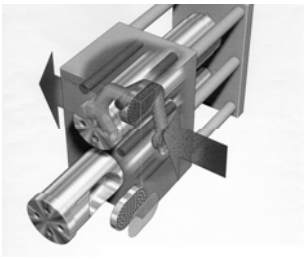


18,000 PPH SAN Polystyrene Production

- Dual piston, (2) 10.63" oval screens
- No loss of production
- Lower maintenance cost
- Increase filtration levels
- Eliminate candle cleaning
- Replace slideplate with candles



Dual piston, oval two screen, continuous

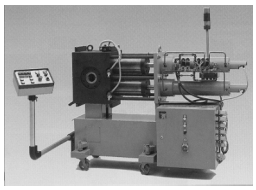


Larger Area

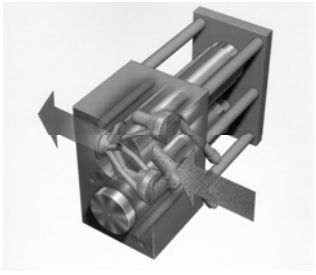
Lower Cost

3,500 PPH Polypropylene Recycling

- Dual piston, (2) 9.07" screens
- Bail wrap and fiber waste
- 200 mesh filtration
- Reduce screen costs
- Up to 80 Back Flushes
- Lower maintenance costs
- Automate with Back Flush



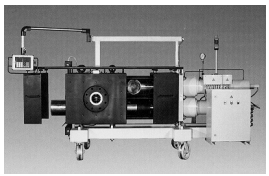
Dual piston, two screen, continuous



Back Flush

2000 PPH, PET Fiber Production

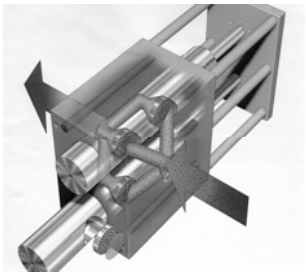
- Dual piston, (4) 6.94" screens
- Continuous polymerization
- High IV PET
- Low total and delta-P
- Explosion proof design
- Extend spin pack life
- Improve overall filtration
- Increase production



3500 PPH, PET Staple Fiber Production

- Dual piston, (4) 9.07" screens
- 200 MM Extruder
- PCR PET, 0.8 IV
- Extend spin pack life
- Increase production
- Low pressure variation
- Improve overall filtration

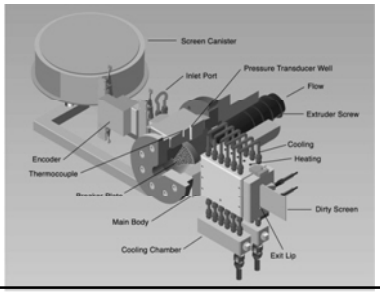
Dual piston, four screen, continuous



Continuous Ribbon Type

Key Filters - Model KCN
Continuous Screen Changers

Ribbon Function



Payback

Inputs

Extrusion Flow Rate (lb/hr)	1000
Material Cost ($/ lb)	$0.40
%of lost Material Recovered	80%
Machine Time Cost ($/ Hour)	$500.00
Labor Rate	$45.00
Screen Changes per day	1

Normal operation extrusion rate in lbs/hour
Raw material polymer cost
Material recovered for in house reprocessing
Operating cost for extrusion line /hr
Labor rate for each operator assigned to line
Number of screen changes in normal 24 hr period

Results

	Fixed Screen	Manual Screen Changer	Hydraulic Screen Changer	KCN Continuous Screen Changer
Flow Rate (lb/hr)	1,000	1,000	1,000	1,000
Material Cost ($/ lb)	$0.40	$0.40	$0.40	$0.40
%of lost Material Recovered	$0.80	$0.80	$0.80	$0.80
Machine Time Cost ($/ Hour)	$500.00	$500.00	$500.00	$500.00
Labor Rate	$45.00	$45.00	$45.00	$45.00

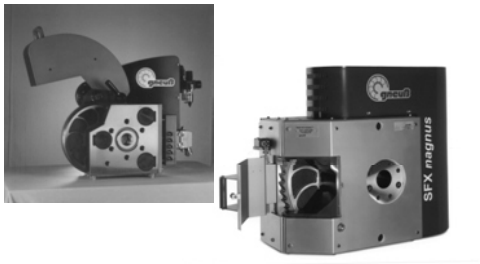
Payback, cont.

Screen Changes per day	1	1	1	Continous
Time to Change Screen (hr)	1	0.3	0.1	0
Machine Time Loss ($)	$500	$150	$50	$0
Material Loss ($)	$320.00	$96.00	$32.00	$0.00
Labor Cost ($)	$45	$14	$5	$0
Screen Cost ($/year)	1225	1225	1225	1550

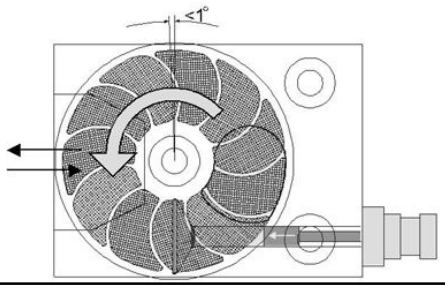
Based on 3.5 " screen pack @ $3.50 /pack or 2 rels of screen/year @ $75.00 ea

Cost per Screen Change	$867	$261	$88	$0
Screen Change Cost per Yr	**$304,675**	**$92,505**	**$31,885**	**$1,550**

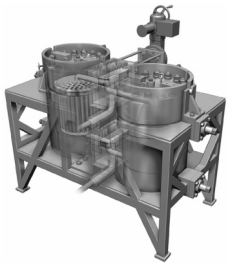
Rotary/Wheel Type



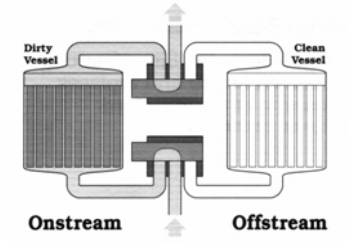
Rotary Function



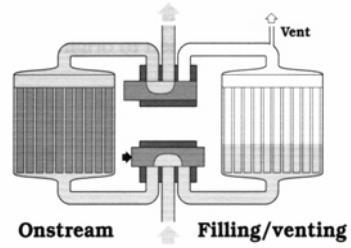
Duplex Large Area Filtration System



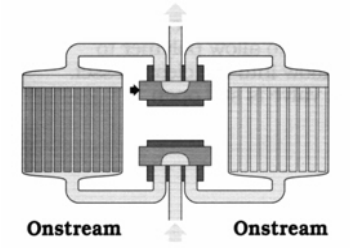
Duplex Large Area Operation



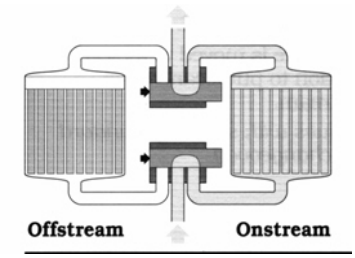
Duplex Large Area Operation



Duplex Large Area Operation



Duplex Large Area Operation



Pricing – Manual, Hydraulic, Ribbon

Style/Type	3-1/2 inch	4-1/2 inch	6 inch	8 inch
Manual	$ 7,115	$ 8,210		
Hydraulic	$ 13,200	$ 15,000	$ 19,400	$ 31,500
Continuous Ribbon	$ 23,700 to $ 29,500	$ 26,500 to $ 39,100	$ 32,500 to $ 46,500	$ 60,600 to $ 71,600

Pricing courtesy of Key Filters, Woonsocket, RI

System Pricing – Piston/Rotary

Supplier	Model	Screen Dia.	Total Area	Price	Options	Comments
Maag Pump Systems	CSC-176	2 x 176 mm	488 cm2	$ 54,295	Cart, $3380 Guard, $3170 Control, $7670	Dual piston, continuous
Gneuss	SFXmagnus 90	1 x 90 mm	346 cm2	$ 79,540	Cart, $2680 Controls, $8750	Continuous rotary type Controls required
JLS International	TSK 6.1	2 x 140x190 mm	530 cm2	$ 53,400	Cart, $3000 Guard, $2100	Dual piston, continuous, with rectangular screens
PSI – Polymer Systems	CSC-148 CSC-176	2 x 148 mm 2 x 176 mm	343 cm2 485 cm2	$ 47,480 $ 57,375	Cart, included	Dual piston, continuous
Kreyenborg	VL-176	2 x 176 mm	488 cm2	$ 36,300	Cart, $2700 Guard, included	Dual piston, continuous

Non-backflush, sized for 2000 pph of PS sheet extrusion

Backflush Pricing – Piston/Rotary

Equipment Supplier	Model	Screen Diameter	Total Area	System Price	Options	Comments
Maag Pump Systems	CSC - 125/BF-4F CSC – 148/BF-4F	4 x 125 mm 4 x 148 mm	500 cm2 692 cm2	$ 77,190 $ 101,260	Cart, $3140 Guard, $2395 Cart, $3380 Guard, $3170	Dual piston, continuous
Gneuss	RSFgenius 150	1 x 150 mm	359 cm2	$ 157,530	Cart, $3530 Controls, $9860	Continuous rotary type Controls required
PSI – Polymer Systems	CSC-148/BF	4 x 148 mm	686 cm2	$ 89,760	Cart, included	Dual piston, continuous
Kreyenborg	K-SWE-125/BF	4 x 125 mm	500 cm2	$ 86,630	Cart, $2840 Guard, $1795	Dual piston, continuous

Backflush, sized for 2000 pph of PS sheet extrusion

Filtration System Suppliers

Company	Melt Filtration Products	Location
JLS International	Continuous Piston, Large Area	Charlotte, NC
Kreyenborg GmbH	Continuous and Backflush Piston	Atlanta, GA/Germany
Dynisco	Manual, Slide Plate, Continuous Piston	Hickory, NC
Key Filters, Inc.	Manual, Slide Plate, Continuous Ribbon	Woonsocket, RI
Gneuss GmbH	Slide Plate, Continuous and Backflush Rotary	Charlotte, NC/Germany
PSI - Polymer Systems, Inc.	Manual, Slide Plate, Continuous Piston	Hickory, NC
HiTech	Continuous Ribbon	Hackensack, NJ
Econ GmbH	Continuous and Backflush Piston	Greenville, SC/Austria
MAAG Pump Systems	Manual, Slide Plate, Continuous Piston, Large Area	Charlotte, NC
Erema GmbH	Continuous and Back Flush Piston	Topsfield, MA
Patt Filtration	Continuous Ribbon	Quebec, Canada