



# A Guide to Sealing PAPER RECYCLING PLANTS



- WHY RECLAIM?
- CLEANERS, FIBERIZERS, SCREENS
- DE-INKING
- MIXERS & AGITATORS
- TYPICAL PUMPS
- AUXILLIARY SYSTEMS
- SEAL LOCATIONS

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**ENVIRONMENTAL TECHNOLOGY**

# A GUIDE TO SEALING PAPER RECYCLING PLANTS

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### **ACKNOWLEDGMENTS**

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# Introduction

Pulp and Paper production is a large worldwide industry and each country tends to have its own indigenous production facilities. 75% of the Worldwide Production of Paper and Paperboard (1997) is concentrated in 10 countries as shown below:-

RANKING	COUNTRY	PRODUCTION
1	USA	87
2	JAPAN	31
3	CHINA	27
4	CANADA	19
5	GERMANY	16
6	FINLAND	12
7	SWEDEN	10
8	FRANCE	9
9	SOUTH KOREA	8.5
10	ITALY	7.5
	SUB TOTAL	227
	OTHERS	72

Figures quoted are in MILLIONS of METRIC TONNES.

1997 TOTAL WORLDWIDE – 299 Million Metric Tonnes.

The value of the USA Pulp and Paper + Converting Industry (products from paper) shipments in 1991 was estimated at \$75 billion or 4% of the total USA Manufacturing shipments.

There is significant variation in the amount of RECYCLING undertaken by each Country however it is a continually increasing amount year on year.

In the USA 200 out of the 550 Pulp and Paper production facilities RELY EXCLUSIVELY upon recycled (secondary) fibres for their Furnish (Feedstock). This constitutes about 40% by weight of Paper produced in the USA and mostly comes from NEWSPRINT and corrugated boxes. 70% of all the mills (approximately 400 out of 550) use some fraction of Recycled pulp in their Furnish.

Another example from Europe is the United Kingdom Paper and Board Production.

The total consumption of Paper and Board materials in the UK (1999) was estimated at 12.6 million tonnes.

There are a total of 98 Pulp Paper and Board Mills in the UK producing 6.5 million tonnes (1.4 for Export, 5.1 for Home use). Due to the lack of indigenous raw paper pulp production (8% of total consumption) in the UK, there is a significant paper fibre reclamation industry which accounts for about 65% (4.2 million tonnes in 1999) of British industry's fibrous raw material production. The industry is divided into 3 main paper production types i.e. newsprint, office quality and cardboard. Whilst many of the Production Processes are similar within the different Plants, the Feedstock quality defines the Final Product.

The following text will concentrate upon newsprint paper reclamation which uses clean, dry newspapers and magazines processed in plants capable of consuming 450,000 tonnes of feedstock, yielding 370,000 tonnes of recycled newsprint (approximately 80% efficient) per annum.

## WHY RECLAIM?

The World consumption of paper products is massive (12 million tonnes 1994 in the UK), therefore the DISPOSAL problems are also massive, traditionally involving either incineration or landfill.

The latter method is now environmentally unacceptable and the availability of sites much reduced.

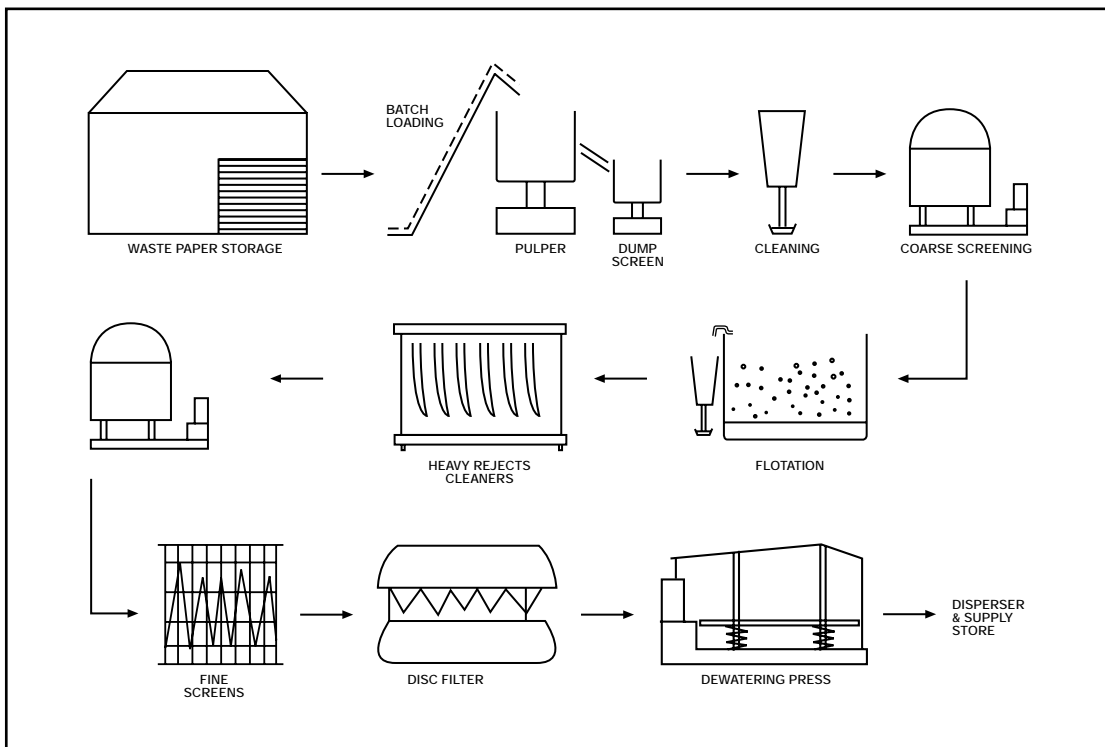
The former is seen to be wasteful of natural resources i.e. requiring more tree felling (to replace 100% loss of processed paper) which reduces the capacity to "clean up" ozone depletion gasses via photosynthesis. It is also claimed that raw pulp manufacture produces significantly more Nitrogen Oxide, Sulphur Oxide and Methane as well as requiring higher water and power consumption.

Recycling plants will be found adjacent to large cities which have the largest concentration of paper waste i.e. the primary requirement for the feedstock. Strategies for collection of this waste product involves public donation as well as commercial bulk supply.

## TYPICAL MANUFACTURING PROCESS

The feedstock to the plant although clean and dry does contain contaminants, i.e. INK, STAPLES, PLASTIC etc. and a major part of the system is used to remove these contaminants followed by increasing the paper fibre concentration.

A schematic of the process is shown below:-



# PAPER RECYCLING PROCESS

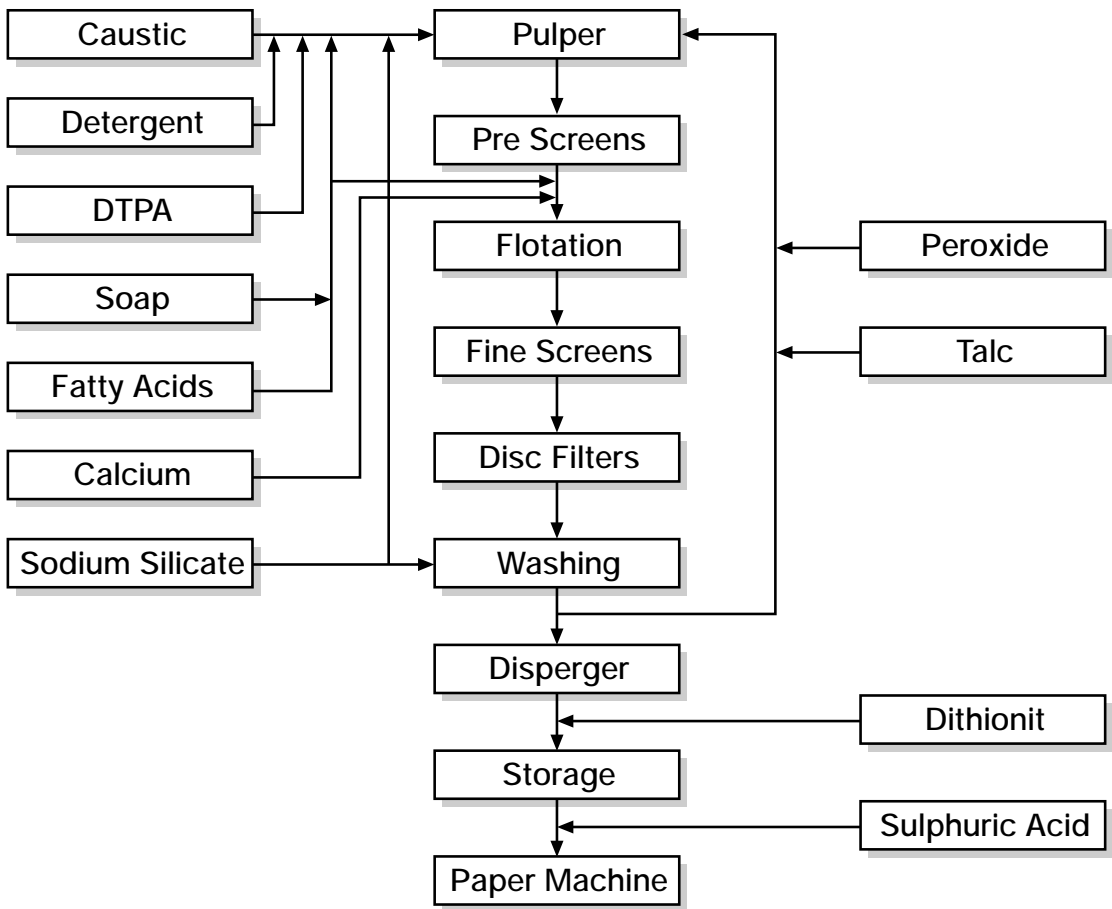
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## FEEDSTOCK STORAGE

The process requires massive amounts of raw material (1200 tonnes/day) which is stored in large hangar type buildings. The waste is continuously fed to the plant via mechanical shovel loaders and conveyor belts. Even at this bulk stage the mixture of paper types in the feedstock is "roughly controlled", to be consistent with the required finished product.



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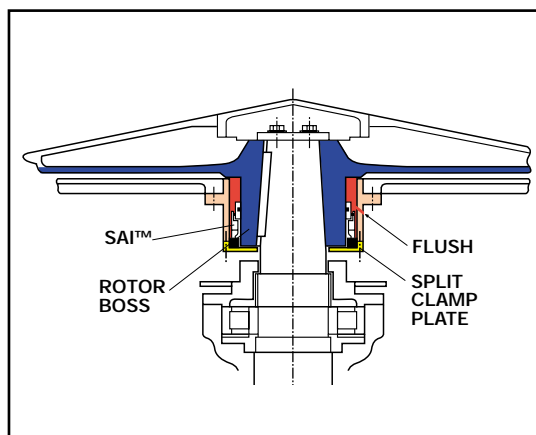
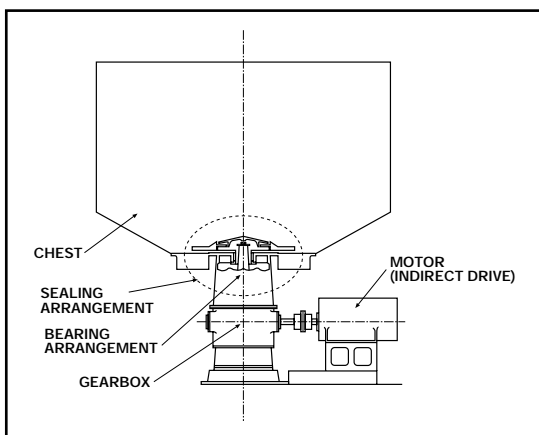
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## PULPING

Typical BATCH hydropulpers.



The first processing operation is carried out in the PULPER, a cocktail of Water + Caustic Soda + Hydrogen Peroxide + Sodium Silicate + Talc + Pelletized Soap and Fatty Acids is used in conjunction with mechanical stirring (e.g. rotation of tank or rotor) to break down the DRY Cellulose fibres in the feedstock to WET Cellulose fibres separated from the coloured inks. The chemicals are added for the following reasons:-

Caustic Soda . . . . .BREAK DOWN FIBRE  
 Soap and Fatty Acid .Initial Ink Collection  
 Talc . . . . .Initial Dispersing agent  
 Sodium Silicate . . . . .WETTING AGENT  
 Hydrogen peroxide . .BLEACHING

Large unwanted debris (coarse rejects) is also removed during this process e.g. plastic bags, CD's etc.

Continuous production pulpers are becoming more popular, they are constructed as large horizontal rotating vessels rather than the vertical orientation of batch production units.



**CLEANERS / FIBERIZERS / SCREENS**

The mixture, consisting of paper pulp + chemicals + inks + small debris is passed to the first of a series of Cleaners/Fiberizers/Screens. Many different designs are on the market under various titles e.g. Turbo Separator, Cyclone Cleaner, Combisorter, Fiberizer.

A typical view of a Turbo separator, Fiberizer and Cyclone Cleaner is shown below. As can be seen (in the Turbo Separator) the fibre mixture is pumped (forced) through the Separator Backplate whilst at the same time centrifuging the heavier components towards the reject outlet. This combination of centrifugal force and some form of screen barrier is extremely common in the design of most Cleaners/Fiberizers/Screens. Also a common feature of this machine type is the ability to adjust the rotor position to account for wear. This sometimes requires the use of CMAX format seals (axial displacement seals).

The Cyclone Cleaner combines the principle of a centrifugal screen with a hydrocyclone. The feed into the screen is tangential, heavy rejects fall under gravity to the bottom outlet, fibre is centrifuged through the perforated basket and lightweight rejects exit from the top of the cleaner.

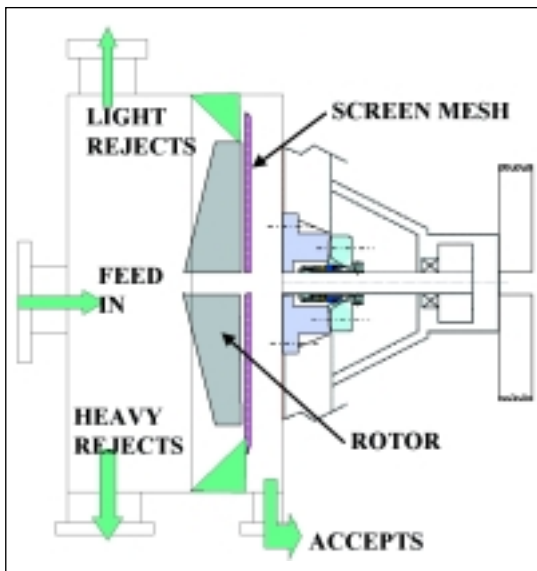
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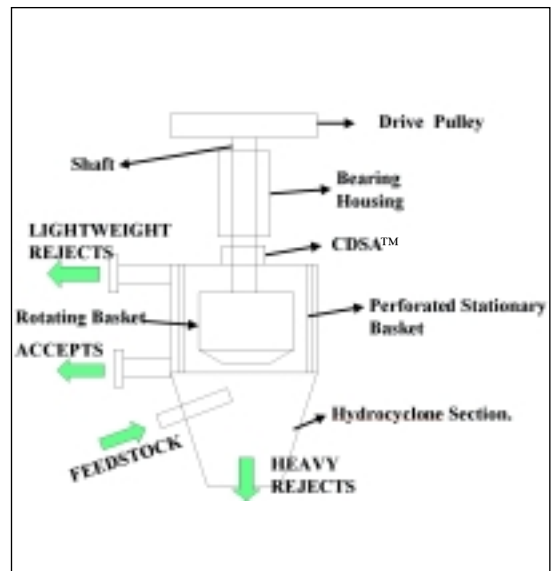
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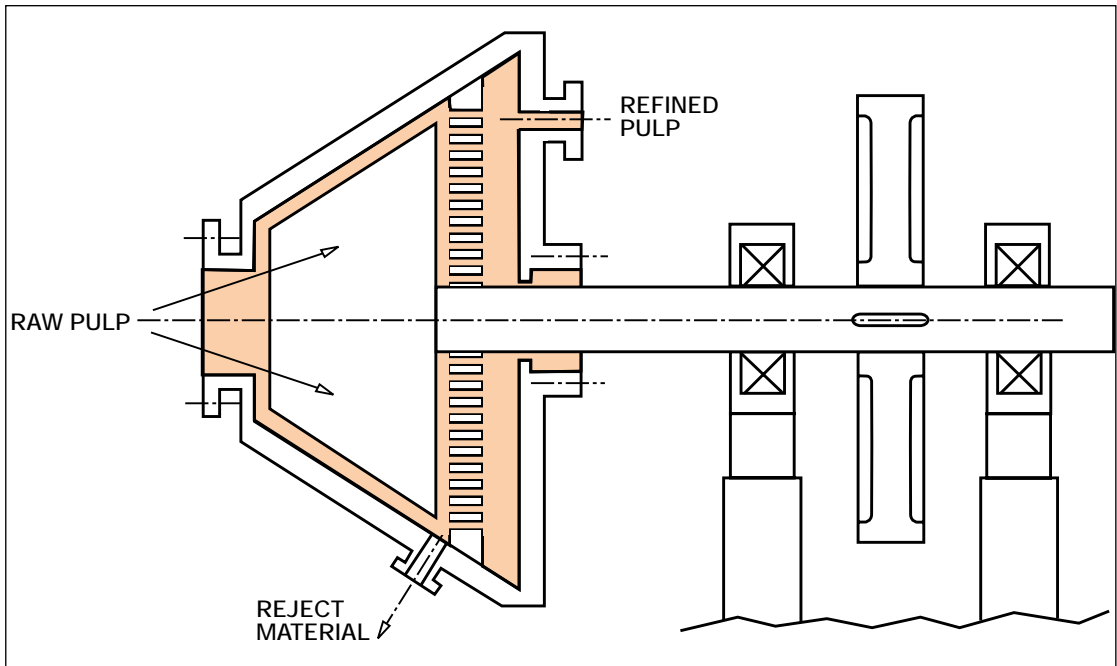
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Typical Fiberizer



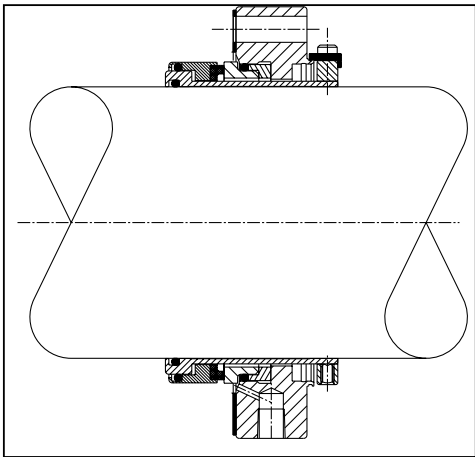
Typical Cyclone Separator



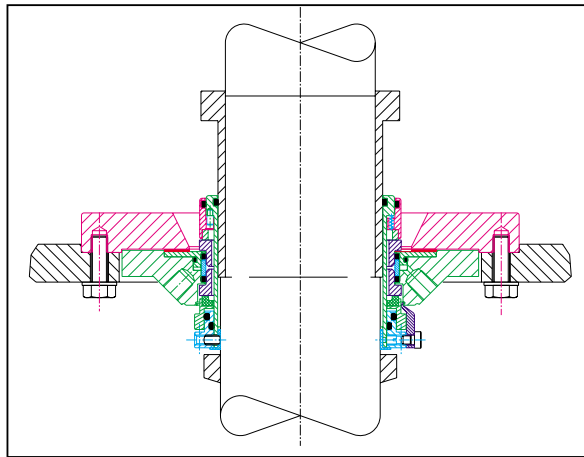
Typical Turbo Separator







Typical Fiberizer seal design



Typical Cyclone Cleaner seal design

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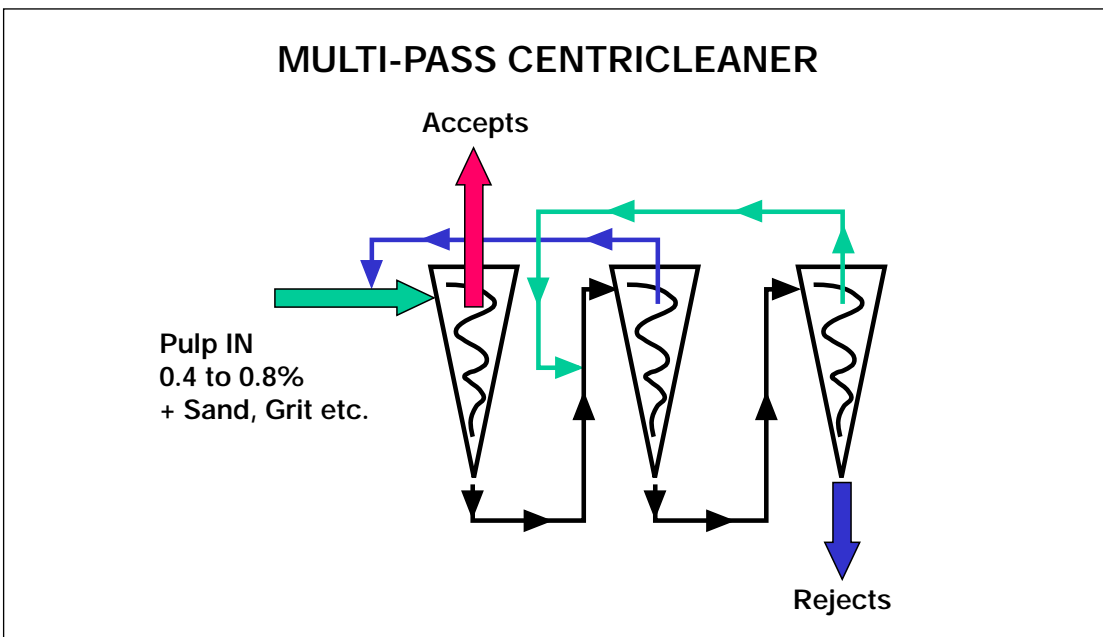
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### PRIMARY SCREENING

The mixture is now passed through a Primary Screening process, designed to remove smaller debris e.g. sand, grit, staples, plastics and bindings.

Typical Screen units used are Centrifugal Cleaners arranged in multi-pass format.



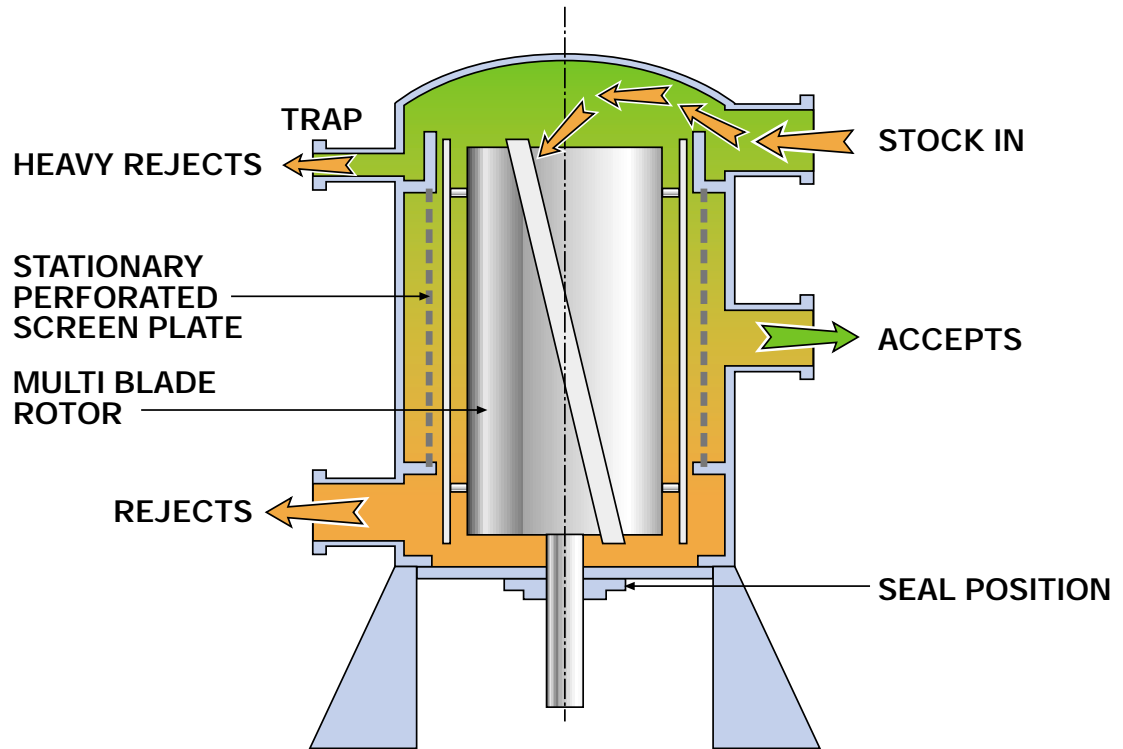
The units work as conventional Hydrocyclones i.e. the product at a consistency of 0.4% to 0.8% pulp + sand and grit etc. is pumped into the unit TANGENTIALLY at the top. The fluid flow is then circumferential and the denser particulate matter is centripetally accelerated to the outside diameter of the cyclone vessel. The densest particles i.e. sand and grit fall under the influence of gravity towards the BOTTOM outlet (REJECTS outlet). The less dense products i.e. water and pulp fibres are forced to flow up through the top centre of the cyclone (ACCEPTS).

Theoretically the PULP + water is separated from the contaminants, however some pulp would leave the rejects outlet and in order to recover this product, thereby increasing the efficiency of separation, cyclones are connected in large banks as MULTI-PASS systems (as shown above).



It is often the case that centrifugal cleaners are followed by a series of COARSE Pressure Screens.

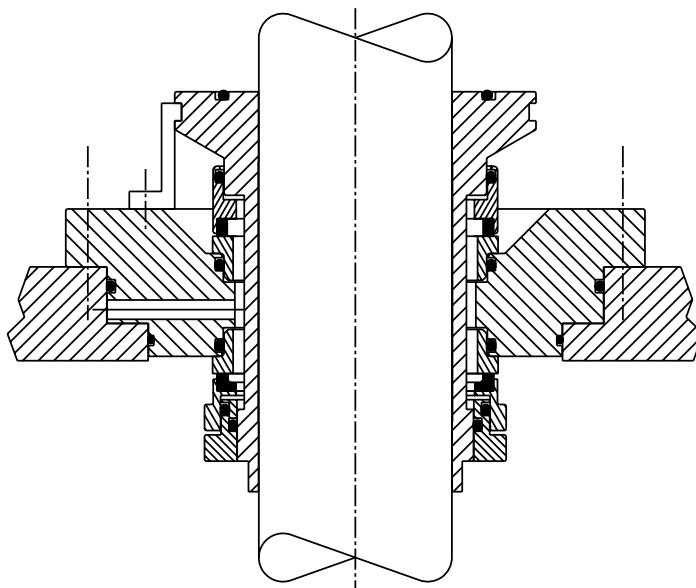
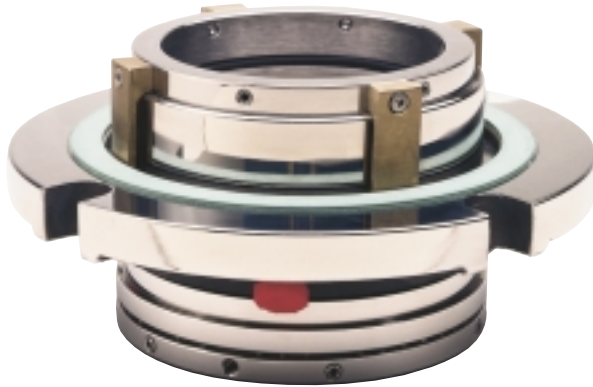
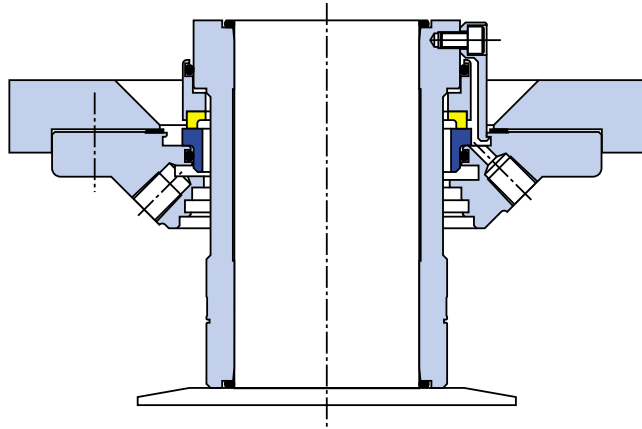
Typical Vertical Pressure Screen.



Thin stock typically 0.4 to 2% having had sand and grit removed still contains other contaminants e.g. plastic, synthetic fibres which can be screened out using Pressure Screens. The Pressure Screen works as follows (see above). The thin stock enters the screen tangentially at the top and the flow is obstructed by a weir separating the heavy particles which exit through the TRAP. The pulp flows over the weir and passes through the annular space between a rapidly moving rotor and a stationary basket (see above). The rotor is designed to create RADIAL PULSATIONS within the flow which assist in forcing the pulp fibres through the screen slots. Typical slot/holes widths are 0.030" (0.4mm). The screened pulp fibres pass through to the ACCEPTS branch of the screen. In order to maintain continuous throughput the screen must contain means to prevent "Blinding" of the basket (i.e. blocking), a common method is to use screen plate dilution water flow, which dislodges debris on the rejects side of the screen (see above). Rejects fall to the bottom of the screen and exit via the Rejects Port.

The pressure screens are periodically removed for thorough cleaning on a planned maintenance routine.

TYPICAL SCREEN SEAL DESIGNS



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**LIGHT WEIGHT CLEANING**

Contaminants whose density is low and similar to pulp require special treatment to enable removal from the process stream. One of the most modern and efficient (99%) methods used is the Rotary Cleaner (e.g. Gyroclean)

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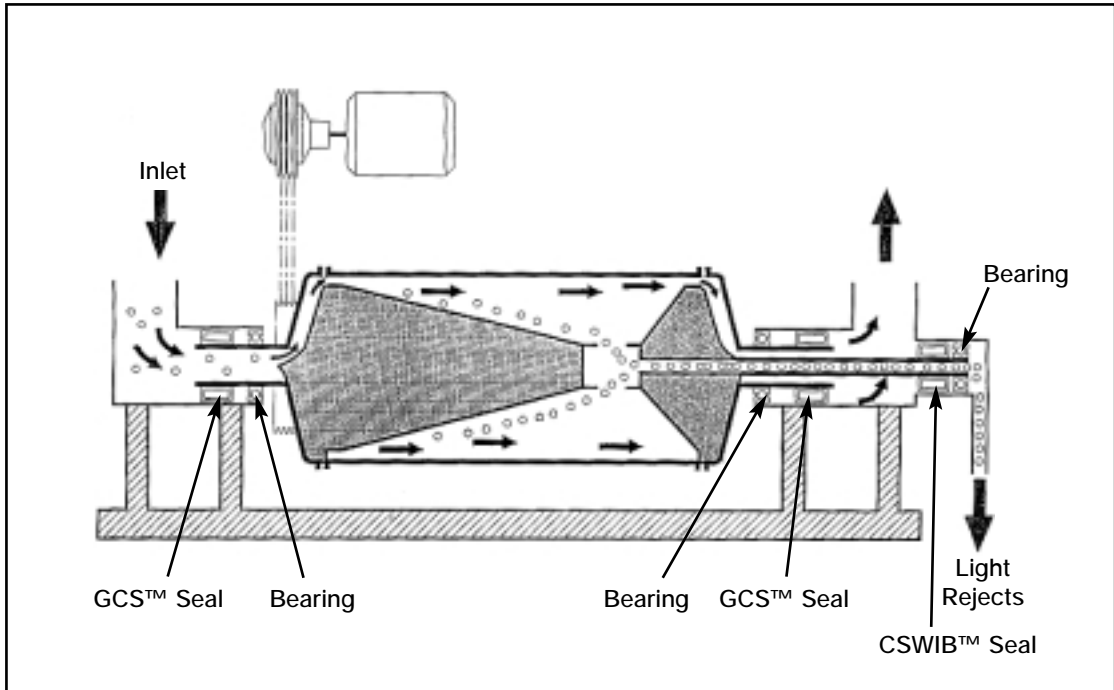
This machine is specifically designed to remove Polyethylene, Polystyrenes, "Stickies" & "Hot Melts".

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As can be seen above the machine consists of a large horizontal vessel supported on 2 journal bearings. Each of these bearings is protected by a Double Mechanical Seal. The stock is fed to the rotating vessel and separation takes place due to the density difference between the stock and the lightweights (e.g. Polystyrene). The stock centrifuges to the outside and the rejects flow towards the centre tube, which is supported on an external bearing requiring a mechanical seal on its inboard side.

The Accepts from the Primary Screening are passed to the De-inking process.

## DE – INKING

The Thin Stock still contains the ink which was chemically separated from the paper fibres in the pulper, it is now removed from the product in Flotation or Wash Cells.

## FLOTATION CELL

The pre-screened pulp fibre and liquid is pumped through a series of Flotation Cells in which soap and fatty acids are added to react with the Calcium in the aqueous mixture. The reaction creates a surface "scum" .

Air is introduced into the mixture (at the bottom of the cell) to promote the formulation of bubbles to which the ink particulates become attached as the bubbles rise and expand.

The scum turns into a black froth which is skimmed or overflows from the top of the cells.

During the above process the individual fibres are dispersed to aid removal of the ink particles.

The flotation cell is capable of removing ink particles from 5-500 microns (0.0002" to 0.020")

## WASH CELLS

This is similar to the above process however the pulp is dispersed and washed without the aid of air and collected mechanically from the wash bath.

## SECONDARY SCREENING

A second series of Hydrocyclones and Pressure Screens are employed to remove more of the smaller contaminants. The particulates removed are much smaller and therefore the screens have slots typically sized 0.003"(0.08mm) to 0.018" (0.45mm) wide.

## SECONDARY FILTRATION

Many different methods exist for filtration of pulp fibre at this point e.g rotary vacuum filter, rotary disc filter etc.

Both the above designs consist of a large horizontal cylinder which slowly rotates partially immersed in pulp fibre suspension. The filtration process normally involves 3 distinct phases:-

- 1) Pick up of fibre onto the Filter Cloth from the liquid suspension.
- 2) Drying of the fibre which collects on the Filter Cloth as the filter slowly rotates. Again the vacuum draws air past the fibre clinging to the Filter Cloth.
- 3) Removal of the fibre using mechanical scrapers or more likely the modern approach of using water jets. During the removal process the vacuum is cut off.

The pulp consistency into the filter is normally about 1% and outlet consistencies from 12 – 15% are normal.

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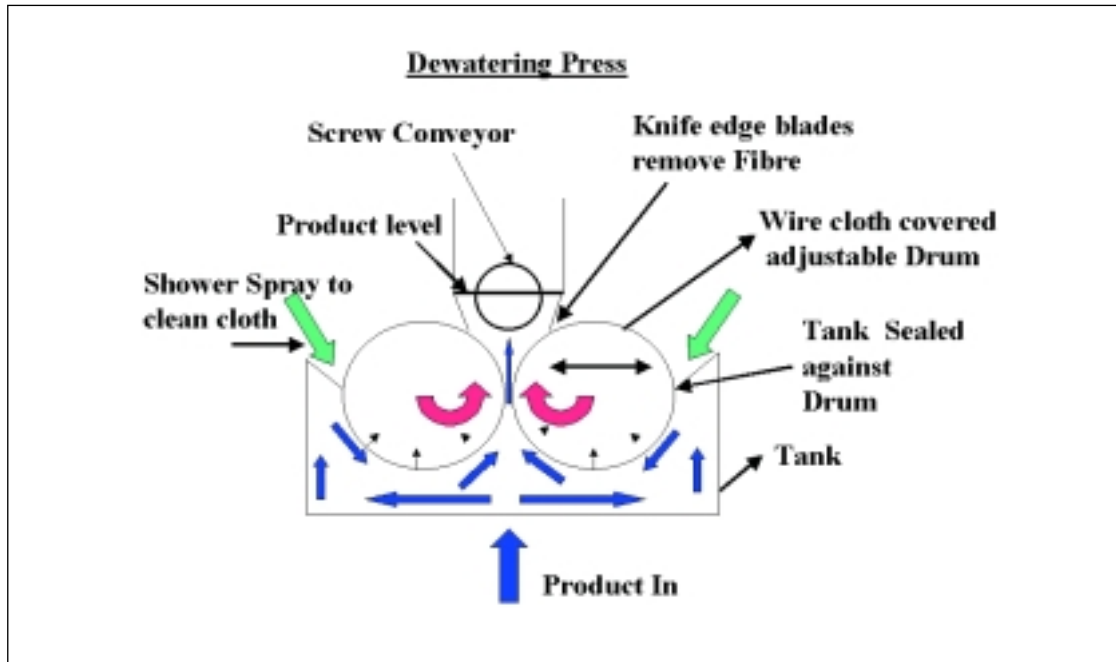
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**DEWATERING PRESS**

The thin stock at around 3% - 5% enters the Dewatering Press to increase the stock consistency. Again there are many designs for Dewatering Presses, however as the name implies some form of mechanical load is applied to assist in thickening the fibre consistency.

The simplified cross section below shows one such method:-



Product with a consistency of 3% - 5% is pumped into the tank at a pressure of 0.2 to 0.6 barg (3 to 9 psig). The drums are made from thin perforated steel covered with a wire cloth (i.e. porous), therefore the filtrate (liquid + minor suspension of solids) is easily forced through the cloth into the inner part of the drums, where it is transported away from the press.

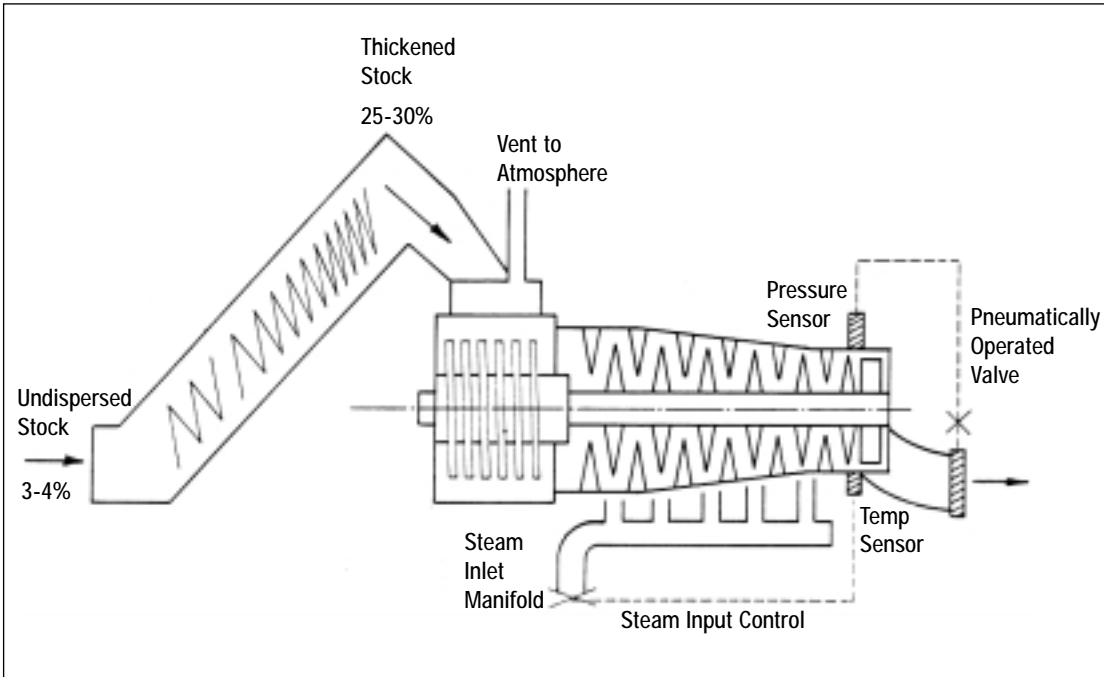
The fibre mat which is now created on the surface of the wire cloth is forced/nipped between the 2 rotating drums, where it is further and substantially dewatered/dried to a consistency of 12 - 15%.

The fibre is removed from the cloth mechanically by use of Knife edge plastic scrapers and finally exits the Press via a Screw Conveyor.

## DISPERSER (DISPERGER)

Even at this late stage the pulp can contain waxes and inks from the waste paper feedstock, therefore rather than trying to remove them from the final product they are FINELY DISPersed within the stock. The particulates are essentially invisible to the naked eye when dispersed within the final paper products.

The machine used for this process is called a DISPERSER or DISPERGER, again different designs exist but have certain common features.



As can be seen above the product is introduced into the Disperser via a screw feeder. Within the machine the product is dispersed between rotating and fixed blade(s).

Steam is added to the process to melt down the wax/plastic contaminants in order to promote the dispersion process.

The O.E.M seals on these units are normally BACK to BACK in water jacketed enclosures.

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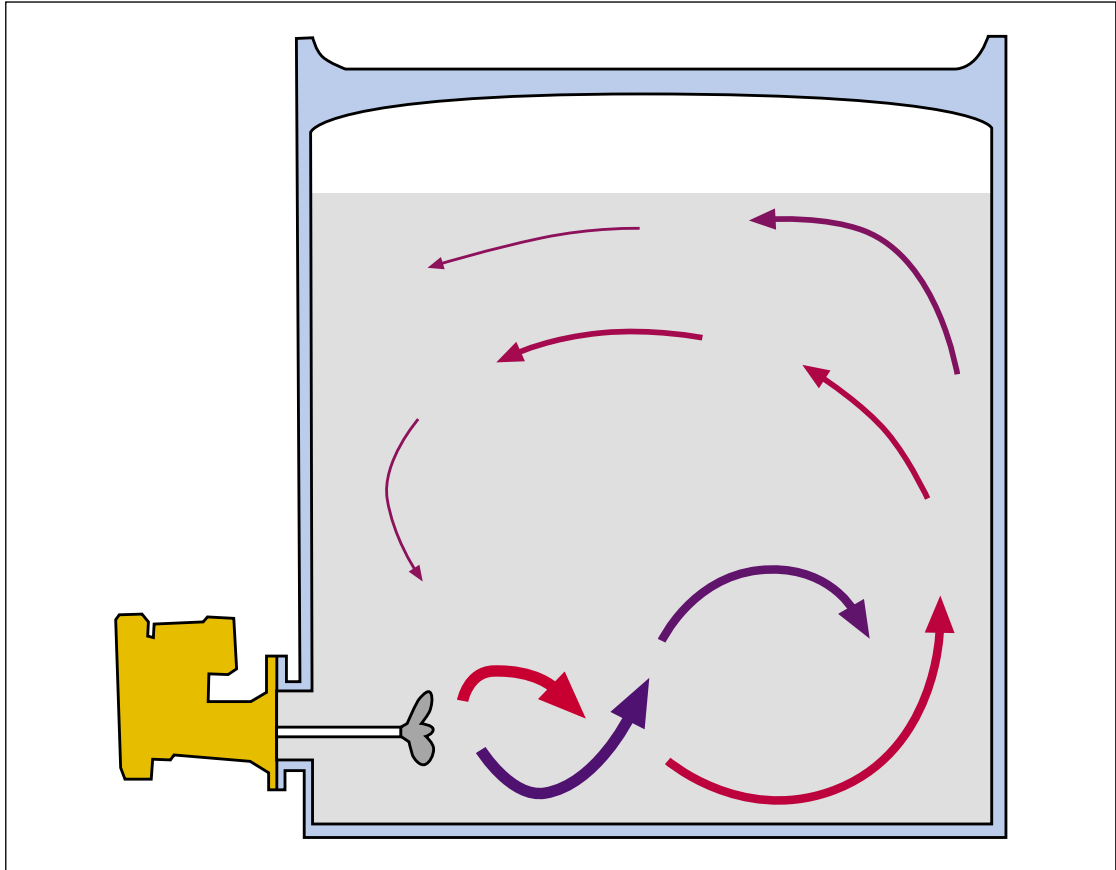
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**MIXERS AND AGITATORS**

Throughout the recycling process heavy use is made of mixers and agitators to maintain the fibre in suspension and enable pumping of the stock to be possible. Virtually every operation carried out on the stock is followed by a holding tank (chest) which acts as the suction feed to the pump systems. The agitators/mixers are normally side entry units as shown in the schematic below:-



The typical seals used are CDM™ and RDS™ units dependent upon ease of maintenance.



CDM™ Seal



RDS™ Seal



## TYPICAL PUMPS USED IN A PAPER RECYCLING PLANT

The typical pumps found in a recycling plant are those of proven design for use in any paper plant i.e. end suction and split case centrifugal. The typical pulp and paper pump is of robust construction and certain manufacturers have specialized in their manufacture and supply e.g. AHLSTROM, ABS SCAN PUMPS, GOULDS, VOITH, SULZER, BLACK and CLAWSON etc.

The typical end suction centrifugal pump would have the following design features irrespective of the manufacturer:-

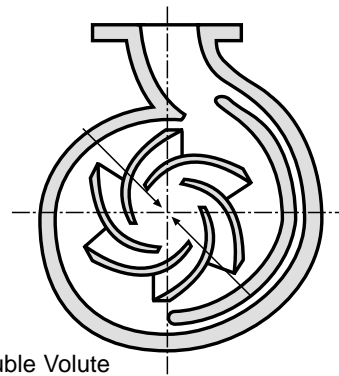
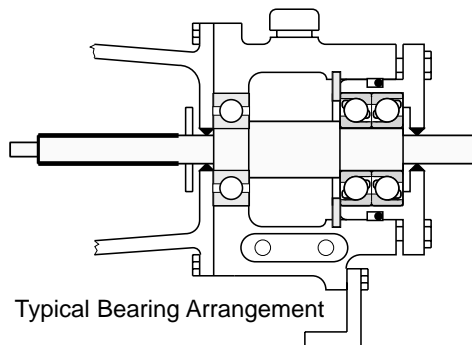
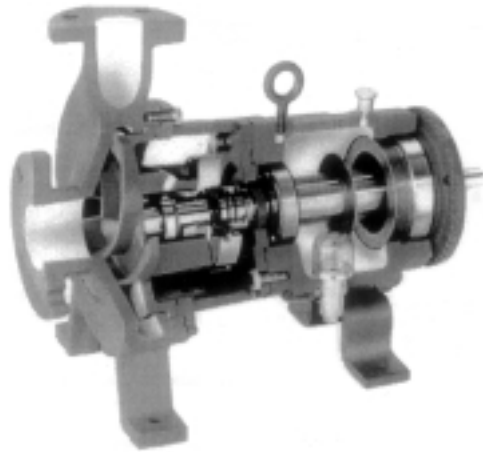
- 1) Heavy duty shaft, typical deflection at the stuffing box 0.002".
- 2) A pair of heavy duty angular contact bearings (see typical cross section) in back to back configuration at the drive end of the bearing cartridge.
- 3) Heavy duty roller at the pump end.
- 4) Short overhang to impeller (small  $l^3/d^4$  ratio).
- 5) Robust (thick sections) OPEN design impeller.
- 6) Provision of sacrificial (replaceable) wear surfaces in the volute chamber.
- 7) Larger pumps tend to include a double volute to decrease radial thrust on the impeller.
- 8) Ability to pump up to 7% stock.
- 9) The volute chamber tends to be Cast Iron whilst the Impeller, Shaft, Sleeves and Wear Plates are wear resistant stainless steel. Above 120°C (248°F) the Pump would be completely stainless steel.
- 10) Laser alignment of Pumpsets, during installation. Acceptable Vibration levels for Centrifugal Pumps are shown below:-

CENTRIFUGAL PUMPS		
SPEED (RPM)	DISPLACEMENT (MILS)	VELOCITY (IN/SEC)
1800 OR LESS	3	0.27
1800 - 4500	2	0.3

1 mil = 0.001"

Most of the above mitigate towards "good mechanical seal life". However the MOST IMPORTANT FACTOR contributing to adequate seal life is without doubt the use of appropriate STUFFING BOX design.

Modern pump stuffing box designs for use in fibre plants are generally based upon the "flared/taper, big bore concept".



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## Seal Chamber Selection Guide

Goulds Engineered Seal Chambers Provide Best Seal Environment For Selected Sealing Arrangements/Services

	<b>A</b> Ideally Suited	<b>B</b> Acceptable	<b>C</b> Not Recommended	<b>TYPE 1 Standard Bore</b> <i>Designed for packing. Also accommodates mechanical seals.</i>	<b>TYPE 2 BigBore™</b> <i>Enlarged chamber for increased seal life through improved lubrication and cooling. Seal environment should be controlled through use of CPI flush plans.</i>	<b>TYPE 3 TaperBore™ PLUS</b> <i>Lower seal face temperatures, self-venting and draining. Solids and vapors circulated away from seal faces. Often no flush required. Superior patented design maximizes seal life with or without solids and vapor in liquid.</i>	<b>TYPE 4 Jacketed Stuffing Box</b> <i>Maintains proper temperature control (heating or cooling) of seal environment.</i>	<b>TYPE 5 Jacketed BigBore™</b> <i>Maintains proper temperature control (heating or cooling) of seal environment with improved lubrication of seal faces. Ideal for controlling temperatures on services such as molten sulfur and polymerizing liquids.</i>
<b>Service</b>								
Ambient Water with Flush	A			A	A	A	-	-
Entrained Air or Vapor		C		C	B	A	C	B
Solids 0-10%, no Flush		C		C	C	A	C	C
Solids up to and greater than 10% with Flush		B		B	A	A	B	A
Paper Stock 0-5%, no flush		C		C	C	A	-	-
Paper Stock 0-5%, with flush		B		B	A	A	-	-
Slurries 0-5%, no flush		C		C	C	A	C	C
High Boiling Point liquids, no flush		C		C	C	A	C	C
Temperature Control		C		C	C	C	B	A
Self-Venting and Draining		C		C	C	A	C	C
Seal Face Heat Removal		C		C	A	A	C	A
Molten or Polymerizing liquid, no flush		C		C	C	B	C	C
Molten or Polymerizing liquid with flush		C		C	B	B	C	A

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Above chart reproduced courtesy of Goulds Pumps

Where enclosed stuffing boxes are employed, flushing is required to avoid blocking of the radial space between the seal rotary and the stuffing box bore.

Erosion of the seal glandplate must be avoided by careful design when sealing flared/taper bore stuffing boxes.

Wear resistance to erosion and abrasion are important factors when selecting pumps to circulate paper stock and duplex steels are popular choices on demanding duties, normally incorporated as sacrificial wearplates.

Most of the pumped systems use single impellers therefore on most occasions the discharge pressures are < or = 10 barg (145 psig).

# Typical Mechanical Seal Specification for Paper Recycling Duties

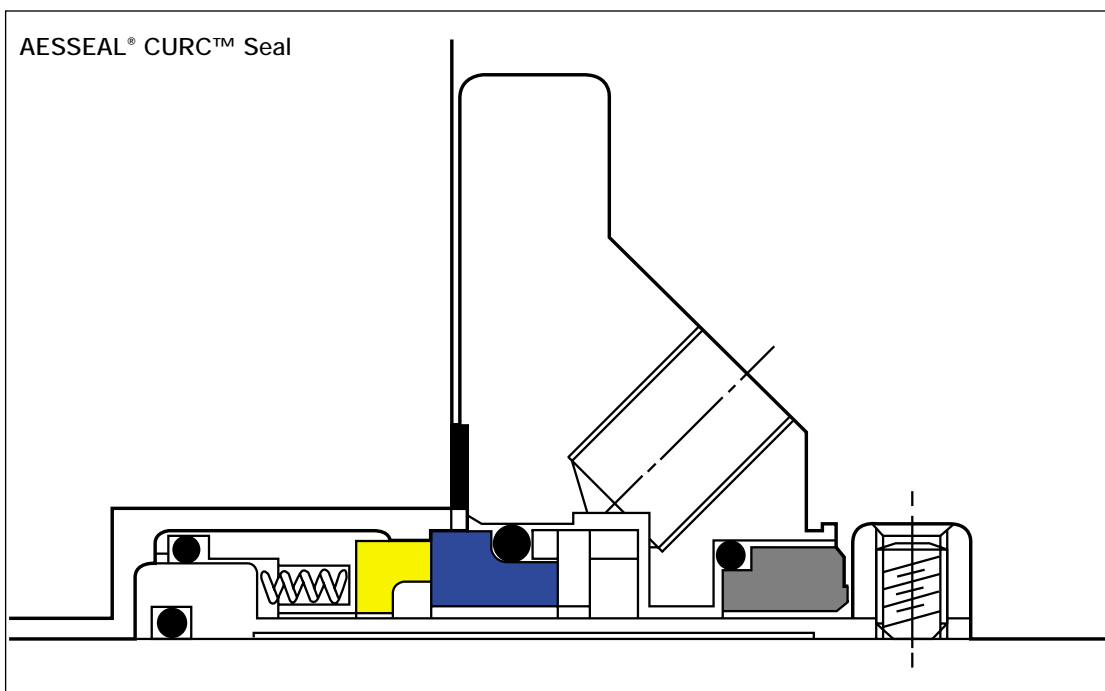
## METALLURGY

Most of the chemicals and materials used in the process are either inherently non-corrosive or in concentrations which have negligible effect upon AISI 316L stainless steel. Therefore AISI 316L is the preferred metal for mechanical seal parts.

## SEAL FACE MATERIALS

Tungsten Carbide (Nickel bound) has the appropriate combination of hardness and toughness required for paper pulp recycling duties and is universally used as the choice for single seal and double seal (internal) faces. Whilst paper pulp does not appear particularly abrasive it would rapidly cause deterioration of soft seal face combinations e.g. Carbon. The use of HARD faces internally is therefore able to resist contact with the fibre and reject materials, however it presents a seal system problem of ensuring the TOTAL prevention of DRY RUNNING at the seal faces.

As previously discussed pulp fibre pumps can have either ENCLOSED or OPEN box configurations and the seal system differs dependent upon this choice as follows:-



A product like pulp fibre would rapidly clog the small clearance (<0.060") between the seal rotary and the stuffing box I.D., causing rapid face wear and abrasion of the rotary O.D. Upon removal of the pump the user finds solid fibre seized around the stationary face, disrupting any heat transfer which would have taken place. The seal would effectively overheat and the faces crack. The most effective solution (assuming pump modification or replacement is impossible), to this condition, is the provision of an external source of clean flush water (Plan 32).

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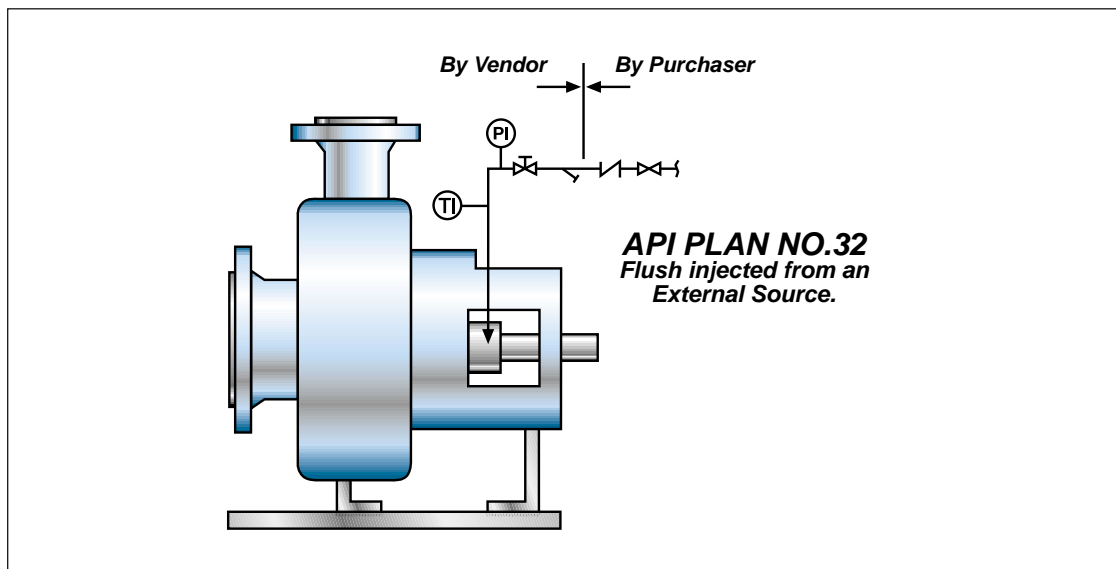
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ENVIRONMENTAL TECHNOLOGY

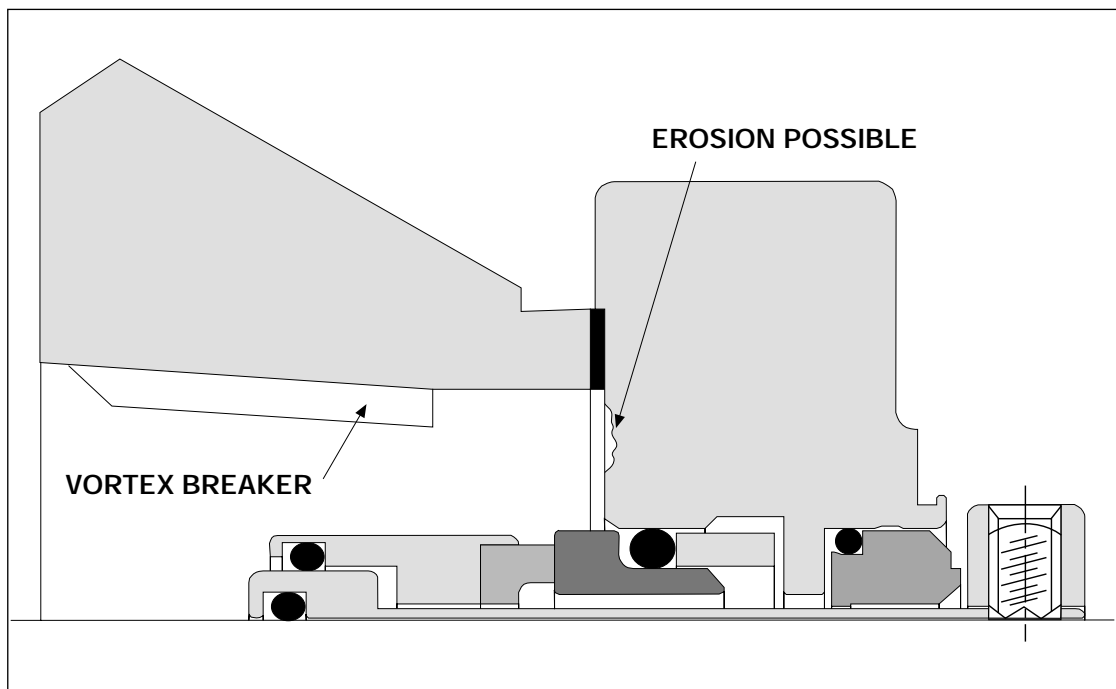


The water source for Plan 32 should be as clean as possible, however recycled filtered process water is often successfully used for this purpose.

Pulp plants are extremely resistant to increasing their process water consumption, therefore towns/utility water supply is rarely a viable alternative. Even recycled water is important to the user and the flush flow is often controlled using variable orifice flow meters.

Using quench water alone on ENCLOSED boxes is not a solution to the problem of blocking on the product side. The seal faces will probably not "burn" out but severe erosion of the rotary will take place.

### OPEN STUFFING BOX DESIGN



The seals face a different problem with open boxes i.e. if not correctly designed, severe erosion can take place at the gland. Clogging is no longer an issue but it is often prudent on higher pulp concentrations (>2%) to use a quenched seal, thereby preventing the blockage of the internal/spring cavities of the seal (atmospheric side), which would eventually lead to seizure of the seal rotary causing severe leakage of product.

Double seals will always out perform a single type mechanical seal when used in conjunction with a pressurized (water) barrier fluid. This is because the internal seal faces are sealing water not product. Double seals are used where maximum seal life is required and in these instances a double seal will often outlast the normal life of the pump. Double seals are additionally used in the most arduous duties i.e. where the pump is run outside its design duty parameters, where there is high levels of air entrainment & prolonged dry running,

On pumping applications double seals should be specified where concentrations exceed 6%.

The preferred installation is the water management (W1 – W4) system, which provide the necessary protection for the seal faces combined with minimum maintenance requirement.

The outboard faces of the double seals would use Carbon versus Chromium Oxide since the buffer/barrier fluid is water.

### ELASTOMERS

Without doubt AFLAS is the most popular elastomeric compound used in pulp and paper plants, combining the resistance of EPR to hot water and Alkalis with the performance of Viton on Acids and oils. AFLAS provides the user with a single solution for his plant and therefore reduces the stock inventory required.

### GASKETS

AF1 the standard AESSEAL® gasket is suitable for all duties.

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# AUXILLIARY SYSTEMS

The 2 main systems employed in the recycle plants are:-

- 1) Flush water control using a variable orifice flowmeter.
- 2) Buffer fluid provision via W1 – W4 water management system.

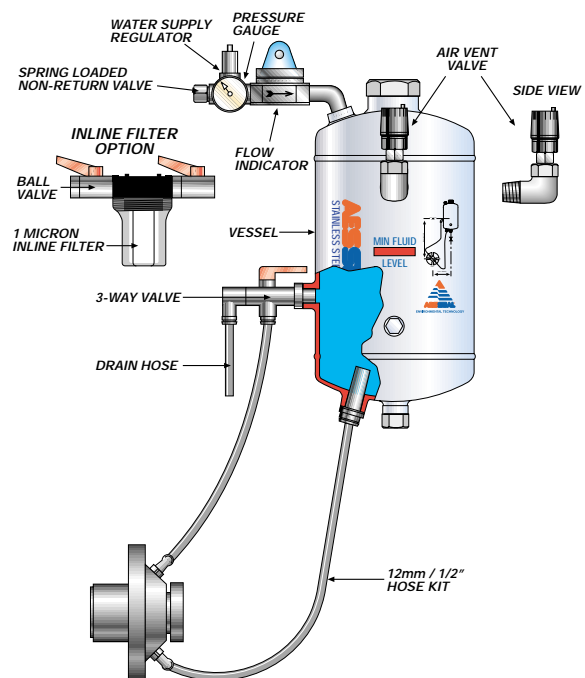
## FLUSH WATER CONTROL

Dilution of pulp within enclosed stuffing boxes has already been described. The process requires some form of flow control to limit the consumption of valuable water supplies. The typical design of these units combine a VARIABLE ORIFICE flow control with a flow indicator. It should be noted that flush connections require the measurement and indication of flow rather (or as well as) pressure. N.B. You can have pressure with ZERO flow.

Further information is available from AESSEAL® MCK Ltd.

## WATER MANAGEMENT SYSTEM

SSE10™ SYSTEM W2  
WATER MANAGEMENT  
SYSTEM VESSEL  
CODE VSE/SW02



The basic water management (W2) system uses a clean cold water supply to pressurize and cool the double seal (e.g. CDSA™). In the event of poor water quality a filter option should be used, noting that this will only filter the initial 2 gallons fill required for this vessel and in a normal 12 month usage period will have only filtered 6 to 8 gallons.

The system avoids the complexity of GAS pressurization and also further reduces the risk of dry running the external seal faces due to lack of maintenance (i.e. failure to top up the vessel). The system is self-filling and since pulp stock is normally >95% water losses to or from the product stream are compatible.

The normal thermosyphon principles apply therefore the system is sized with regard to its heat removal capacity and may include finned tubing should an additional heat dump be required (W3).

For further information obtain the "SSE10™ Thermosyphon and water management systems" Brochure.

# Seal Locations on a Paper Recycling Plant

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## DUMP TANK RECIRCULATION PUMP

Concentration 2.5% / 4%

Temperature 40°C (104°F)

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™ + LABYRINTH	CURE™
I/B Faces	TC/TC	TC/TC/CRO2/C
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 62	PLAN 62

## GYROCLEAN ROTOR SEALS

Concentration 0.8%

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	GCS™ BACK TO BACK +PUMPING RING	GCS™ BACK TO BACK +PUMPING RING
I/B Faces	TC/TC	TC/TC
O/B Faces	TC/C	TC/C
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	WATER TO DRAIN	WATER TO DRAIN

## GYROCLEAN ACCEPTS SEAL

Concentration 0.8%

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CSWIB™	CSWIB™
I/B Faces	TC/TC	TC/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System		



*DUMP TANK PUMP***Concentration 2.5% - 4%****Temperature 40°C (104°F)**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™ + LABYRINTH	CURE™
I/B Faces	TC/TC	TC/TC/CRO2/C
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 62	PLAN 62

*PRESCREEN FEED PUMP***Concentration 3% TO 4%****Temperature 50°C (122°F)**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™ + LABYRINTH	CURE™
I/B Faces	TC/TC	TC/TC/CRO2/C
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 62	PLAN 62

*PREFLOTATION STOCK***Concentration 2.5% - 4%****Temperature AMBIENT**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™ + LABYRINTH	CURE™
I/B Faces	TC/TC	TC/TC/CRO2/C
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 62	PLAN 62

*PREFLOTATION FEED PUMP***Concentration 1.2%****Temperature AMBIENT**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	TC/TC	TC/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-



## FLOTATION CELL PUMP

### Concentration

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDSA™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	AFLAS®	AFLAS®
Gasket	AF1	AF1
System	PLAN53+ W1-W4	PLAN53+W1-W4

## FLOTATION CELL SLUDGE PUMP

### Concentration 2%

### Temperature 45°C (113°F)

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDSA™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	AFLAS®	AFLAS®
Gasket	AF1	AF1
System	PLAN53+ W1-W4	PLAN53+W1-W4

## 1ST/2ND STAGE CLEANER FEED PUMPS

### Concentration 0.8%

### Temperature 45°C (113°F)

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDSA™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN53+ W1 SYSTEM	PLAN53+W4 SYSTEM

## 3RD AND SUBSEQUENT STAGES CLEANER FEED PUMPS

### Concentration 0.8%

### Temperature 45°C (113°F)

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

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*FINE SCREEN (FS) LIGHT WEIGHT CLEANER PUMP***Concentration 0.8%****Temperature 45°C (113°F)**

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDSA™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN53+ W1 SYSTEM	PLAN53+W4 SYSTEM

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*FINE SCREEN FEED PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

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*CLOUDY FILTRATE PUMP***Concentration 0.2%****Temperature AMBIENT**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

*DEWATERING PRESS FILTRATE PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## POST FLOTATION STOCK PUMP

### Concentration 1.2%

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	TC/TC	TC/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## POST FLOTATION FEED PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## LIGHT WEIGHT (LW) CLEANER FEED PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDSA™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	AFLAS®	AFLAS®
Gasket	AF1	AF1
System	PLAN52+ W1 SYSTEM	PLAN53+W4 SYSTEM

## WIRE PRESS FILTRATE PUMP

### Concentration 0.16%

### Temperature 45°C (113°F)

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDSA™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	AFLAS®	AFLAS®
Gasket	AF1	AF1
System	PLAN53+ W1 SYSTEM	PLAN53+W4 SYSTEM

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*DE-INKED FIBRE PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™ + LABYRINTH	CURE™
I/B Faces	TC/TC	TC/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 62	PLAN 62

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*WIRE PRESS FEED PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™ + LABYRINTH	CURE™
I/B Faces	TC/TC	TC/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 62	PLAN 62

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*ALKALINE DISPERSION PUMP***Concentration 0.01%****Temperature 45°C (113°F)**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

*NEUTRAL DISPERSION WATER PUMP***Concentration 0.01%****Temperature 45°C (113°F)**

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## WASTE WATER DISPERSION PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## ALKALINE LOOP WASTE WATER FLOTATION PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## ALKALINE CLEAR WATER PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## NEUTRAL CLEAR WATER PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

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*WASTE WATER FLOTATION CLEAR WATER PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

*SLUDGE DEWATERING FILTRATE PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

*EFFLUENT STORAGE PUMP*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CURC™	CURC™
I/B Faces	C/TC	C/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

*SCREW FEEDER (DISPERSER/DISPERGER)*

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	RDS™	RDS™
I/B Faces	C/CRO2	C/CRO2
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## FIBERIZER

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	SINGLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CSM™	CSM™
I/B Faces	TC/TC	TC/TC
O/B Faces	-	-
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## TURBO SEPARATOR

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDM™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 53 + W4 SYSTEM	PLAN 53 + W4 SYSTEM

## PRESSURE SCREEN FEED PUMP

Option	Minimum Spec.	Best Available Spec.
Seal Type	SINGLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	IASC	IADC DOUBLE
I/B Faces	TC/TC	TC/TC
O/B Faces	-	TC/C
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	-	-

## CYCLONE CLEANER

Option	Minimum Spec.	Best Available Spec.
Seal Type	DOUBLE SEAL	DOUBLE SEAL
Metal Types	AISI 316L	AISI 316L
Specific Design	CDM™	DMSF™
I/B Faces	TC/TC	TC/TC
O/B Faces	CRO2/C	TC/C
Elastomer	VITON®	AFLAS®
Gasket	AF1	AF1
System	PLAN 53 + W4 SYSTEM	PLAN 53 + W4 SYSTEM

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FOR FURTHER INFORMATION AND SAFE OPERATING LIMITS CONTACT OUR TECHNICAL SPECIALISTS AT THE LOCATIONS BELOW.



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WITH HAZARDOUS PRODUCTS.  
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- GUARD YOUR EQUIPMENT
- WEAR PROTECTIVE CLOTHING



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