RakeMax® Multi-Rake Screens

Screening Considerations – A Guide to Selection

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INTRODUCTION

Proper screening is one of the most important steps in the operation of a WWTP. Poor screenings removal affects safety, maintenance and operation of the WWTP. The following processes downstream of the headworks are affected by improper screening treatment:

1) Grit removal: Without proper screening, debris will accumulate in the grit trap, causing wear on equipment. Furthermore, it will affect grit quality in terms of volatile solids content in the grit (larger bar spacing -> higher VOC in the grit) and physical appearance (debris in the dewatered grit). A grit washer, which classifies AND washes the grit slurry in lieu of a classifier only, might help to alleviate this problem. It is the author's recommendation that fine screens are installed PRIOR to grit removal units.
2) Clarifiers: Screenings debris might impair the operation of clarifiers. Some debris may float on the surface impairing skimming of the surface and other materials might settle in the bottom impairing operation of skimmers and pumps. Additionally, floating debris in a clarifier is visually unpleasing.
3) Digester equipment. Digester mixers and heat exchangers could potentially be blocked by accumulated screenings debris, making it necessary to clean digesters and heat exchangers on a frequent basis.
4) Pumps: Pumps might block and wear out faster due to screenings debris. This is especially true for grit removal pumps and Primary - RAS pumps.
5) Dewatering Systems: Dewatering systems, especially centrifuges and belt filter presses are negatively affected by screenings debris in the sludge to be dewatered. Screenings debris also

poses a problem as far as appearance of the dewatered cake goes. It is not desired to see plastic materials and other material mixed together with the dewatered sludge. Furthermore some sludge drying systems require the debris in the dewatered cake to be limited to a certain size (e.g. 3/8”) to prevent operational problems for dryers.

Above listed points directly affect the operational cost of a WWTP to a significant degree. In addition to these factors, the following factors also should be considered when planning for a new screen installation or a screen retrofit.

1) Odors: Most fine screens today can be installed with enclosures, greatly reducing odor concerns in the headworks area. Many screening systems offer a flanged connection on the enclosure to run the fouled air through an odor control system.
2) Physical appearance and safety of the headworks: Many of today’s system are made of stainless steel, thereby ensuring long life cycles. Some of today’s fine screens are pieces of art, having not much in common with previous generations of coarse screens. As fine screens have evolved, so have their design, their reliability, their maintenance friendliness, and their life cycles. Great care is taken in today’s design to address all issues from life-cycle cost to operator friendliness and visual appearance. Today’s fine screens are typically will exhibit a smaller footprint than coarse screens. Their profile above the channel is lower than that of climber screens and therefore they allow for lower building heights.

Care must be taken to not try to use a “one size fits all” approach when selecting fine screens. For example, if a low headloss is required for plant A, and a high screening capture rate is required for plant B, the selected screenings system for each plant would most likely look different. Each application is unique, and therefore each selection process should be treated as such.

The trends towards fine screens should necessitate the selection of a proven, reliable and high performing screenings/washing compactor. The washer compactor should have the following features and be able to achieve the following parameters:

- Full stainless steel construction for low life cycle cost
- Fully enclosed to contain odors
- Dry solids content of discharged screenings at least 35%. Screenings must pass the EPA paint filter test.
- Volume and weight reduction of at least 60%.

These factors will become more important as disposal costs will increase. Therefore, a well working washer/compactor must be integral part of a proper screen selection process. In Europe, the trend goes to washer/compactor systems with additional agitation features so that a maximum fecal removal rate and thus weight and volume reduction is ensured. These type of systems guarantee a cleaner, less odorous headworks environments and reduced disposal costs by returning feces back into the treatment process.

DESIGN CONSIDERATION

Screen channels should be designed for approach velocities between 2fps (0.6m/s) and 3.3fps (1m/s). If velocities drop below 2fps, grit and screenings might accumulated upstream of the screen. Accumulated debris might lead to functional problems once a peak flow flushes that debris to the screens within a short time period. If velocities are higher than 3.3 fps (depending on the screen type) debris might bypass the screenings media and end up downstream of the screen. The velocity in the channel can be controlled by utilizing a parshall flume downstream of the screen, or by controlling the wet well water levels. In addition to that, baffle plates can be used to increase the approach velocities to the screen. Sometimes aeration equipment is installed prior to the screen to keep grit suspended to avoid significant sedimentation prior to the screen at low flow scenarios. If large amounts of rocks and gravel are present, a rock trap also can be installed upstream of the screens. This rock trap could be emptied either manually or automatically with the means of a screw auger.

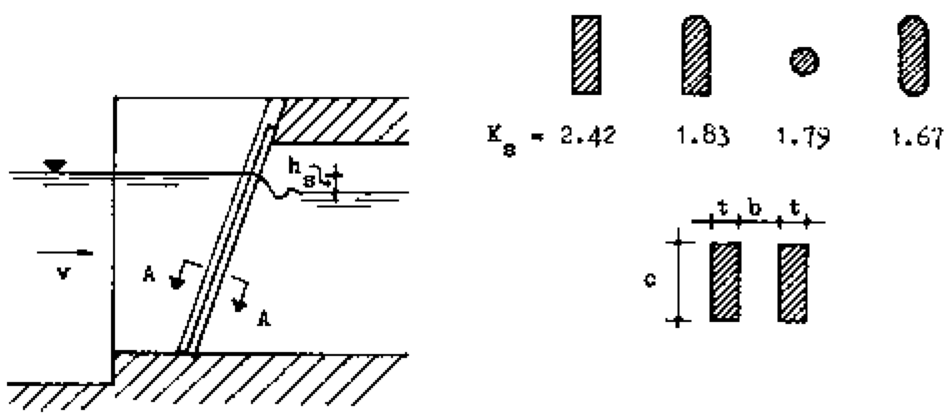
Before selecting and sizing a screenings system the following points should be considered:

- Current plant flows – future plant flows
- Required screenings capture rate or required bar spacing (does the plant process require a certain capture rate, E.g. MBR plants)
- Headloss across the screen
- Screenings handling, processing and disposal
- Existing or new construction – available space
- Relationship between daily average flow and peak flow
- Wastewater characteristics (grit, gravel, branches, leaves, FOG content, tools and sheets -> prisons)
- Construction, capital cost vs. Life-cycle cost
- Outdoor or indoor installation
- Controls

Typically, at least two mechanical screens should be installed so that one unit can be taken out for service or maintenance. If only one unit is to be installed a manual bar rake must be installed to provide an emergency bypass. One slide gate shall be installed prior and one after the screen. Please take care to allow enough space for the pivoting, if the screen system comes with such a feature.

Headloss of fine screens: An important figure in the design of a screenings system and the design of a WWTP is the headloss associated with a screen. Most screen manufacturer use one or another form of the Kirschmer formula for calculating the headloss of a fine screen.

Head loss in screens, values of screen loss coefficient K_s for various bar shapes (Mosonyi, 1963)



Kirschmer's formula

$$h_s = K_s \left(\frac{t}{b}\right)^{\frac{4}{3}} \frac{v^2}{2g} \sin\alpha$$

where

h_s = loss of head, m
K_s = screen loss coefficient
t = thickness of bars, m
b = clear spacing between bars, m
v = velocity of approach, m/sec
a = angle of bar inclination, degree

FINE SCREEN TYPES

ROTAMAT® Fine Screen Ro1

Ro1 Rotamat® Fine Screen

The ROTAMAT line was invented by Huber in 1983. Since then, Huber has installed more than 5,000 ROTAMAT screens. A common feature for all ROTAMAT machines is that screenings removal, screenings washing, conveyance and compaction are all accomplished with one drive. The main part of the Ro1 is the rotating rake which positively cleans the rake tins. No wash water or brush is required to clean the screenings drum.

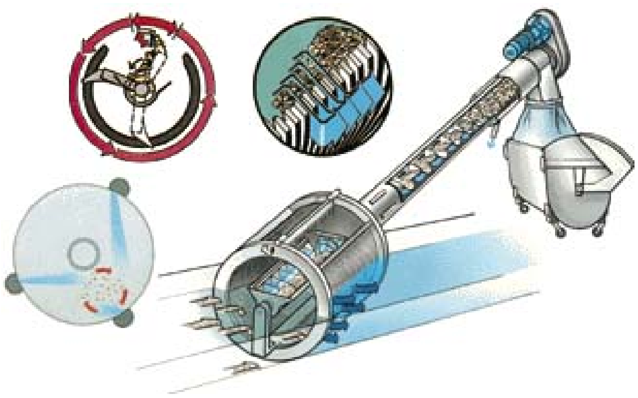


Figure 1:
Schematics of a Fine Screen Ro1

Figure 2:
Huber ROTAMAT® Fine Screen Ro1
installed at Merrill, WI

Advantages	Disadvantages
Low headloss	Low screenings capture rate (SCR)
Integrated screenings washer/compactor	Limited to about 10ft channel depth
Self-cleaning, well suited for FOG, no wash water for cleaning necessary	Lower permissible water level in channel due to the drum design, thus wider channel required
Low maintenance – lower bearing fully enclosed	
Energy efficient – One motor only	
Pivoting possible (up to certain sizes)	
Very rugged, reliable operation	
Outdoor installation possible with frost protection package	
Simple controls	
Well suited for screening of septage and primary sludge	
Enclosed design available	
Well proven-Thousands of installations worldwide	
High screenings loads	

- Max. drum diameter is 3m or 10ft which is good for about 50 MGD (3/8” bar spacing)
- Available bar spacing 3/8” or ¼”
- Can be installed in tanks (Septage receiving station)

ROTAMAT® Rotary Drum Fine Screen Ro2

Ro2 Rotamat Screens

One of the most versatile and well proven fine screen used worldwide, the rotary drum fine screen is available with wedge wire, perforated plate or woven mesh wire media (for MBR applications).

Figure 3- Ro2 installation in Denmark

Figure 4- Ro2 installation in Alaska (with frost protection package)

Advantages	Disadvantages
High screenings capture rate, especially for perforated plate screen (RPPS)	Limited to about 10ft channel depth
No screenings carry-over	Lower permissible water level in channel due to the drum design, thus wider channel required
Integrated screenings washer/compactor	
Well suited for heavy grit and gravel loads	
Low maintenance – lower bearing fully enclosed	
Energy efficient – One motor only	
Pivoting possible (up to certain sizes)	
Very rugged, reliable operation	
Outdoor installation possible with frost protection package	
Simple controls	
High screenings loads	
Enclosed design available	
Wedge wire, perforated plate, woven mesh screenings media available	
Well proven – Thousands of installations worldwide	

- Max. drum diameter is 10ft (3m) which is good for about 40 MGD (1/4” wedge wire spacing)
- Available bar spacing is from ¼” to 1/100”
- Can be installed in tanks

STEP SCREEN ®

SSV Stepscreens

The step screen consists of a set of movable and stationary bars, which are set parallel to each other. The movable bars oscilate in an elliptical motion, lifting the screenings carpet up on the stationary steps, eventually discharging them onto the discharge chute.

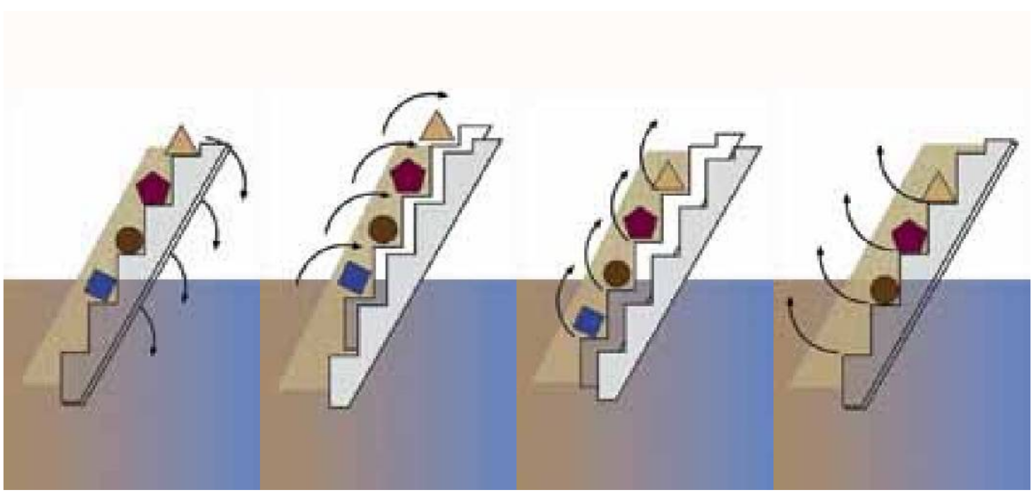


Figure 5- Function of the Step Screen

Figure 6- Step Screen at Reno Stead, NV

Figure 7- Step Screen at Gardner, KS

Figure 8- Deep Channel SSV at Rhinelander, WI (Replacing a grinder)

Figure 9- 2xSSV at Morris, IL

Figure 10 - SSV + Vacuum Conveyance System at North Davis, UT

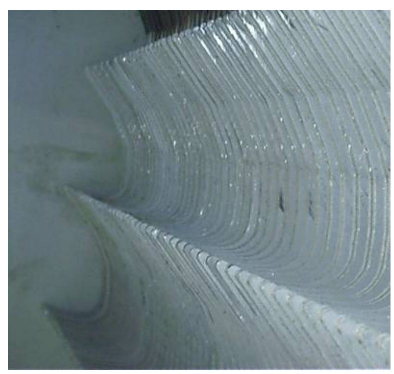


Figure 11- SSV lamellae shape

The Step Screen has the highest hydraulic capacity of any fine screen due to its larger open surface area when compared to any other Fine Screen technology. Step Screens are available with either 3mm or 2mm thick movable and 3mm or 2mm fixed lamellas. For the 2mm option, the open surface area for a clean screen is 75% (3mm thick lamellas = 60%). For 6 mm bar spacing the open area is 60% (3mm thick lamellas = 50%). That makes the step screen an excellent choice for applications where hydraulic constraints are of major concern. Compared to other fine screens, the step screens require a smaller surface area in the channel due to its high hydraulic capacity. As a result civil engineering costs can be minimized. Step Screens works well for plant expansions replacing coarse screens. Depending on length and location, many Step Screens can be designed to pivot out for easy maintenance. Many step screen designs feature a sprocket and chain drive system, which requires regular maintenance while Huber's step screen has a fixed linkage system without any sprockets or chains. No maintenance is necessary except the replacement of the linkage bushings which typically last around three years.

Traditionally, step screens are installed between 45 and 53°. Step Screen with rectangular shaped lamellas (Figure 5) should not be installed at steeper angles due to the danger of screenings roll backs. Huber manufactures a special version of the step screen, the Step Screen Vertical or SSV, which can be used for deep channel applications of up to 22ft. The specially designed lamellae allow the screen to be installed of up to 75°, thus achieving high discharge heights (Figure 9).

The step screen should not be used for applications with heavy gravel loads without design modifications to the channel or to the screen. If heavy gravel loads are present, rock traps prior to the screen can be installed. Huber has a screen design which features an automatic flush bar at the bottom of the screen. This flush bar flushes grit and gravel away from the danger zone underneath the screen towards the grit trap. In order to take full advantage of this feature the screen should be installed at a recess. A mechanically operated "grit flap" door is not a proper substitution for this design of an automatic bottom flush system.

It is also important to note the proper operation of a Step Screen. Step Screens should be operated on a pressure differential (headloss) between upstream and downstream of the screen.   One upstream and one downstream ultrasonic monitor should be installed to control the operation of the screen. A mat or screenings carpet must be formed on the surface of the screen. The thickness of the mat can easily be adjusted by having the screen step more or less often. The proper operation of the screen minimizes the daily operating time of the unit, thus reducing energy cost. Reports from a study in Ashland, Wisconsin, shows that the average daily operating time for a Huber Step Screen is only 8min/day measured over a period of 2 years. The minimal running time significantly reduces wear and tear on the screen and also reduces energy cost. With a properly operating mat, the capture rate of a step screen also increases to about 55% for 1/8" bar spacing which should be sufficient for all WWTP processes except MBR plants.

Figure 12, 13 – Proper screenings mat for a Step Screen

Due to its simplicity, versatility and cost efficiency, the step screen remains a popular choice among many plants across the world. Huber has more than 300 step screen systems in operation in the US since the early 90's. Worldwide, Huber has more than 3,000 Step Screen installations which are used both in municipal and in industrial applications.

Figure 14 – SSV for cooling water intake

Figure 15 – Tank mounted Step screens

Advantages	Disadvantages
High hydraulic capacity	Average screening capture rate
Self cleaning, no wash water or brush required	Limited to 6 ½ ft channel width
Low maintenance, no lubrication necessary	
Energy efficient – One motor only	
Pivoting possible	
Enclosed design	
Well proven – Thousands of installations worldwide	

- Available widths: 18” to 6.5 ft with max. flows of up to 60 MGD per unit
- Available bar spacing: 0.04” (1mm), 1/8” (3mm) and ¼” (6mm)
- Can be installed in tanks

MULTI-RAKE SCREEN

RakeMax® Multi-Rake Screen

This screen is a mechanically cleaned bar screen. The screen consists of a stationary bar rack and multiple rakes mounted on the chain. The rakes clean the bar rakes from the front side of the screen. The RAKEMAX screen has the highest screenings removal rate of any fine screen. This is especially important for deep channels and combined sewers which can see significant variations in the screenings amount to be handled. Multi-bar rake screens are equipped with a two speed motor or a VFD, which allows for the chain drive motor to speed up to increase the screenings removal rate. Additional rakes can also be mounted onto the chain, further increasing the screenings removal capacity. Multi-Bar screens are used mostly in applications were previously Climber-Type screens have been used. They combine the benefits of climber screens (wide, deep channels, rugged) with the benefits of fine screens (finer bar spacing thus higher screenings capture rates, fast screenings removal, lower headroom required for installation). Climber-type screens might be overwhelmed with the screenings amount generated under peak flow conditions during the first hour, especially when mounted in deep channels.

Some Multi-Bar screens do not use a lower sprocket and bearing on the lower turnaround point. This is a questionable engineering practice. With such designs, a guiding ledge (wear ledge) is used to drag the chain around the lower turnaround point. This creates significant wear on the guiding ledge and of course also on the chain rollers. If the guiding rail is not maintained properly (replacing the wear pieces on a regular basis), the chain and the perforated panels will have to be replaced prematurely, at considerable costs to the owner. More advanced designs will use an upper AND lower turnaround sprocket. That will ensure a constant chain tension across the length of the chain and a very precise guidance of the chain and thus a precise alignment of rakes within the bar rack. This is very important for smaller bar spacing (1/2" and less). The lower bearings are fully enclosed and do not need to be lubricated for the Huber design.

The installation angle of the Multi-Bar Screen should be kept between 70° and 75°. This allows for larger screenings debris to be properly conveyed up the front of the screen. This is especially important for screens installed in deep channels.

Advantages	**Disadvantages**
High hydraulic capacity	Lower screening capture rate
Self cleaning, no wash water or brush required	
Low maintenance, no lubrication necessary	
Energy efficient – One motor only	
Pivoting possible for smaller sizes	
Available for channels up to 13ft wide and 60 ft deep	
Low profile above channel floor	
High screenings loads	
Extremely sturdy	

- Available widths: 2ft to 13 ft with max. flows in excess of 100 MGD per unit
- Available bar spacing: 3/16" (5mm) to 6" (150mm)

PERFORATED BAND SCREENS

EscaMax Perforated Plate "Double Pass" Screen

The perforated band screen consists of perforated plate panels attached to a drive chain. Together with Rotary Drum Screen, the perforated band screen has the highest screenings capture rate of any fine screen. Screening capture rates are as high as 90%. It is important to note that a higher screenings capture rate is not necessarily better than a lower one. The required screening capture rate for a plant should be evaluated early into the design process as it will greatly influence the operation of a WWTP. Together with the unwanted materials such as inorganic material, organic matter will be removed as well. This high amount of organic matter must be re-captured and returned to the WWTP by the utilization of advanced washer/compactor equipment. This is extremely important for band screens used for "regular" WWTP's. It is of much lesser importance if the band screens are used for MBR applications where the waste water has already been screened and de-gritted.

There are two types of band screens:

a) The double pass band screen. Here, the waste water passes through front and back side of the screening band. A brush and a spray bar are used to clean the back side of the screen. As the cleaning brush cleans vigorously, screenings can get pushed back into the channel downstream of the screen. For this reason MBR manufacturers do not recommend this type of screen to protect their membranes. The double pass screen is better suited than a center fed band screen for municipal application due to its ability to remove larger particles from the waste water stream. Especially designs which utilize lifting fingers appear to work well in removing larger debris. Important to note is that the installation angle of this screen ideally should be 60° to prevent screenings roll back. The angle should never exceed 75°.

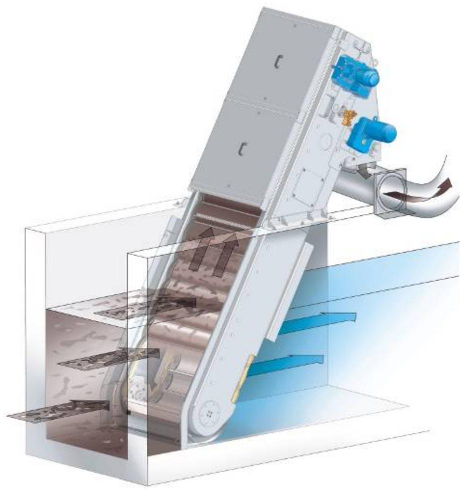


Figure 20 – EscaMax® Perforated band screen

Figure 21 – Perforated band screen (covers removed)

Figure 22 – Between panels

Figure 23 – Lifting fingers

Advantages	**Disadvantages**
High screenings capture rate	Wash water and brush required for cleaning
High screenings removal rate	High headloss through the screen
Pivoting possible for smaller sizes	Screenings carry-over
Low profile above channel floor	Higher operational and maintenance cost
Suitable for grit and gravel	

b) The center fed band screen: The waste water enters the screen through the center of the screen and exits it on the side. Although, this type of band screen can handle higher flow rates than a double pass screen due to its larger screening area, the disadvantage of this installation is that channel needs to be widened in the area where the screen has to be installed (Figure 23). Just like for a Rotary Drum Screen the advantage of this screen is that screenings carryover is eliminated thus making this screen suitable for MBR plants.

Figure 24 – Schematic of center fed band screen (Sketch courtesy of Bracket Green)

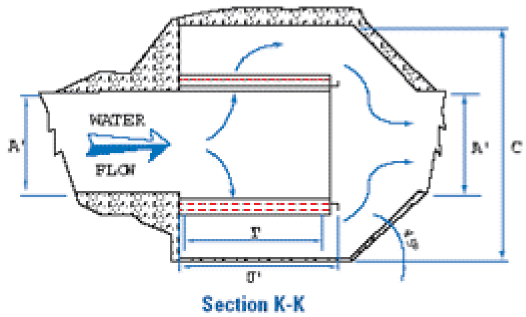


Figure 25 – Installation of center fed band screen (Sketch courtesy of Bracket Green)

Advantages	Disadvantages
High screenings capture rate	High headloss through the screen
High screenings loads	Special channel design required to facilitate screen
Only wash water is required for cleaning	Large debris will not be conveyed out of the channel
Low headloss across screen	Initial construction and capital cost
Low profile above channel floor	
Low energy cost	

CSO SCREENS

These screens are used to screen waste water for CSO applications or the storm run-off from streets. The screen consists of a perforated plate basket and a shafted auger with cleaning brushes. The screen is activated via a level sensor. As the auger is activated via the level sensor the shafted auger cleans the perforations and conveys the screenings to a discharge point at one end of the unit. This well proven technology is simple and reliable. These units have been used predominately across Europe, especially in Germany, and the UK. The screen can be installed in many different configurations.
The perforation openings are either 1/4" or 1/8". One unit can handle up to 180 MGD. Wear on the brushes is very low, thus the maintenance is minimized.

Figure 26 – Stormwater screen RoK1 installed at overflow weir

Figure 28 – Installation underneath a gutter

Figure 29 – Screen in operation during a heavy rain event

PUMP STATION SCREENS

RoK4 Rotamat® Vertical Screen

These screens are used to screen waste water in pump stations. The screen is basically a vertically mounted microstrainer consisting of a perforated plate basket and a shafted auger. It replaces the need for comminutors or grinders by capturing the screenings, conveying, compacting and discharging them into a dumpster at grade level. This innovative design features an optional slide rail mechanism which allows for the unit to be pulled out without having to enter the pump station. Hundreds of these units are in operation worldwide. The perforation openings are either ¼” or 1/8”. One unit can handle up to 4.1MGD.

Figure 30 – Black River Falls, Wisconsin

Figure 31 – RoK4 outdoor installation in Elroy, Wisconsin

MEMBRANE SCREENS

Rotamat® RPPS Center Feed Drum Screen

Membrane Bioreactor (MBRs) systems have become of ever-increasing importance for treating municipal and industrial wastewater in recent years. These systems require more advanced pretreatment as compared to conventional wastewater treatment. Bar screens and perforated plate screens with 3 to 10 mm (1/8" to 3/8") openings by themselves are not sufficient to provide adequate pretreatment. In particular, fibrous materials and hair can cause large challenges in the membrane bioreactor as they may wrap around the hollow fiber style membranes. In addition, trash in the mixed liquor may plug the aerators of the scouring air.

This increased need for finer screening required further development of adequate process technologies ensuring long-term, continuous operation under any condition. Therefore it is necessary to add a micro-screening step as the centerpiece to the mechanical pretreatment process mainly for the elimination of

fibrous materials and hair in the wastewater. Conventional, one-dimensional screens are not capable of providing adequate screenings reduction rates. Consequently, micro-screening was introduced thus adding two-dimensional screen geometry (wire mesh and perforated plate) with a well defined screen opening to the treatment process. This in turn ensures the reliable elimination of fibrous materials and hair.
Experience showed that micro-screening is much more sensitive than conventional screening. Both, the significantly larger screenings reduction rate and the increased sludge content in the total screenings amount, necessitated the development of new technologies.

The Rotamat® RPPS and RoMem® membrane screens were specifically developed to meet this new challenge.

Similar to the already proven Rotamat® platform the RoMem® rotary drum screen is installed at 35° in the channel. It features a two-dimensional wire-mesh with a well defined screen opening thus eliminating fibrous materials and hair from the wastewater. It should be noted that the increased hydraulic throughput of the wire mesh surface as compared to the perforated plate surface is due to the much larger available effective screening surface.

Larger hollow fiber membrane systems require between 0.75 to 1 mm² (750 to 1,000 microns) mesh wire opening. Consequently, an adequate cleaning and sealing system respectively had to be developed. Conventional systems such as brushes and spray nozzle bars had to be complemented with new developments such as high efficiency cleaning. This intensive cleaning consists of a high pressure pump and a moving mechanism. This highly sophisticated system cleans the screening basket with 120 bar (about 1,700 psi) from any residual fibrous material, hairs, and fats. Important to note is that the cleaning takes place upstream of the screen, thus eliminating screenings carry-over.

The RoMem® has been in operation at numerous European sites in front of MBR systems for several years. Measurements at these locations revealed that the wire mesh screens increased the absolute screenings amount by a factor of 3 to 6 as compared with conventional 1 to 3 mm (1/25" to 1/8") bar screens. In addition, experience gained at several sites showed that most of the FOG reduction does not occur in the grease trap/preliminary clarifier but rather in the mesh wire screen.

Moreover, experience showed that the screenings should not be washed out and the refuse returned to the wastewater stream. This procedure entails the danger that silt attached to the organic material as well as additional fibrous materials are returned to the wastewater stream. The large amount of silt in the screenings showed the importance of carefully selecting design and material of the mesh wire screen together with the screenings handling system.

Due to the experience gained over the past few years, it has shown to be imperative to include micro-screening in the design of a MBR system. MBR screens should be preceded by fine screens and grit removal systems. This is especially important for screens with bar spacing smaller than 2mm. Without these measures rapid blinding of the screen might incur especially at larger MBR systems.

Figure 33 – Membrane Screen RoMEM with enclosure and frost protection package

Figure 34 – Membrane Screen [RoMEM](#) with 0.5mm woven mesh

Figure 35 – Rotary Drum Screen [RPPS](#) with 3mm hole openings

Figure 36 – Rotary Perforated Plate Screen at Belle Plaine, MN

SCREENINGS WASHING AND COMPACTION

1. Screenings Amount

Figuring out the screenings amount by calculating it is quite complex. Fortunately, choosing the proper screenings washing/compacting equipment is much easier when using the following guidelines:
General:

- Consult with operators: Owners/operators often have a very good idea of the screenings amount in their plant
- Differentiate between locations: Different locations will have different requirements. For example, combined sewers in locations with long periods of rain will see the most amounts of screenings during the first storm event.
- Sewer and collection systems: The screenings amount in these systems will be significantly higher than those of a separate system. Our European colleagues have observed a screenings amount peaking factor of 3 to 4 for combined systems when compared with separate systems. Separate sewer systems with constant periods of rains will see the fewest screenings. Therefore the most challenging applications in the US are big plants in the Mid-West and the Northwest where dry summers are typically followed by large rain events in the Fall.
- Consider the type of screen: Coarse and rake bar screen require larger screenings washing equipment due to the fact that these screens can deposit huge quantities of screenings within a very short time period. These technologies also require a more rugged piece of equipment accepting larger debris.

Specific:

- Bar spacing and screenings media: Associated with the finer bar spacing have higher screening capture rates. Furthermore the SCR depends on the screenings media (bar, step, wedge wire, perforated plate, and woven mesh). For example, screens which utilize a 1/8" perforated band have a screenings capture rate of up to 92%. A significant amount of organic matter will be removed together with the inorganic matter. That not only creates significant more disposable screenings, it also "robs" the plant of food by removing the organic matter as well. It is essential to return as much of the organic matter back into the treatment process. Properly washed screenings are easier to dewater, thus the volume and weight reduction is optimized. That not only creates a safer work environment by having reduced odors, it also creates savings in the form of reduced disposal costs.
- FOG (Fat, Oil, and Grease): If heavy FOG amounts are present, a hot water connection should be added to the screenings washer/compacting equipment, to keep the drainage slots or perforations of the screenings washing equipment unclogged. This particularly is recommended for slots, especially for those smaller than 1/5" (5mm).

Screenings amount for various types of screens:

Opening size, mm	**Screening capture rate (SCR) in %**	**Moisture content, %**	**Specific weight, kg/m3**	**ft^3/Mgal Range Typical**
25 (bar screen)	15-25	50-80	600-1000	2-5 3
12.5 (bar screen)	20-30	60-90	700-1100	5-10 7
6 (bar screen)	30-40	80-90	900-1100	7-20 13
6 (perf. plate)	70-81	80-90	900-1100	10-28 22
3 (perf. Plate)	80-93	80-90	900-1100	12-35 27
Membrane Screen				
0.5 (woven mesh)*		85-90	1000-1100	40-60 55

* preceded by a 3mm fine screen, followed by grit removal

Data: ATV-DVWK, Metcalf and Eddy, Wastewater Engineering, UKWIR

This chart should serve as a guideline on selecting the properly sized screenings washer/compactor. Care must be taken to size the equipment not for the AVERAGE screenings amount, but for the screenings amount accumulated at the first flush or "surge" during a peak event. Our experience has shown that the screenings amount under peak flow or surge conditions can be 3-4 times higher than under average flow conditions.

Considering this, the sizing of a screenings washer/compactor for a 10 MGD plant with ¼" (6mm) bar spacing should be as follows:

10MGD x 20cuft = 200 cuft/day → 200cuft/d/24hrs = 8.35cuft/hr x 4 peaking → **34cuft/hr** capacity

For a perforated plate screen with 1/8" openings:

10MGD x 35cuft = 350 cuft/day → 350cuft/d/24hrs = 14.6cuft/hr x 4 peaking → **60cuft/hr** capacity

The above example applies to combined systems and sanitary collection systems. The screenings amount in these systems will be significantly higher than those of a separate system.

As a general rule, the screenings washing/compacting equipment should be slightly oversized to ensure sufficient washing capabilities of the equipment even during peak flow conditions.

2. SCREENINGS WASHING/COMPACTION SYSTEMS

   a) Single Stage Washer Compactor

Figure 37 – Screenings washer/compactor behind a step screen in Reno Stead, NV

The screenings are washed in the washing zone (center of machine) by injecting non-potable water into the barrel and compaction zone. Following the washing zone is the compaction zone which essentially consists of a shafted screw with a reduced flight pitch, guide bars bolted onto the barrel and a drainage section. The screw auger pushes the screenings towards the discharge pipe. The majority of the free water gets discharged through the drainage section in the lower half of the barrel.

b) Washers/compactors with agitation feature

Figure 38 – Screenings washer/compactor with launder feed - Clayton West, UK


Figure 39 – Screenings washer/compactor with high pressure Compaction feature

Figure 40 – WAP SL fed via conveyor

CONCLUSION

Fine screens are here to stay. The selection and sizing of your fine screen depends on many variables. Screening capture rate should not be the most important selection criteria. When using a screen with a higher screenings capture rate, the selection of proven, efficient screenings washing/compacting equipment will be extremely important. Combined sewer systems will have a higher amount of screenings than separate systems. Care should be taken to properly size the screenings washing/compacting equipment to account for the "peak flush" screenings amount.

Besides site and space considerations, and the type of sewer system, initial capital cost and operating cost also must be considered when comparing screen systems. Additionally, materials of construction, the manufacturer's experience, corrosion protection, simplicity of operation and maintenance all must be considered before making a selection.

Just as important as the selection of the equipment is the proper sizing of the channel. Approach velocities in the channel shall be between 2fps (0.6m/s) and 3.3fps (1m/s).

Criterias For Screen Selection

Considerations:	Structural				Hydraulics			Wastewater		
	Deep channel	Low headroom	Outdoor inst.	No service water	Capture rate	High water level	Screenings load	Grit, rocks, gravel	Grease	Septic sludge
Ro1	☹	☺	☺	😐	😐	☹	☺	😐	☺	☺
Ro2	☹	☺	☺	☹	☺	☹	☺	☺	😐	☹
Ro9	☹	☺	☺	😐	☺	☹	☹	☹	☹	☹
Ro9 XL	☹	☺	☺	😐	☺	☺	☺	☹	☹	☹
RPPS	☹	☺	☺	☹	☺	☹	☺	☺	😐	☹
RoMem	☹	☺	☺	☹	☺	☹	☺	😐	☹	☹
RoMesh	/	☺	☺	☺	☺	/	☺	😐	😐	☹
SSF	☹	☺	☹	☹	☺	☺	☺	☹	☹	☹
SSV	☺	☺	☹	☹	☺	☺	☺	☹	☹	☹
ClimbMax	☺	☹	☹	☺	☹	😐	😐	☺	☺	☺
EscaMax	☺	☺	☹	☹	☺	☺	☺	😐	☹	☺
RakeMax	☺	☺	☹	☺	😐	☺	☺	☺	☺	☺

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Experts in liquid/solid separation technologies, Huber Technology offer virtually the complete chain of screening, grit, and sludge handling processes. Huber Technology is an original source manufacture specializing in stainless steel fabrication of technologies for water and wastewater.

Huber Technology is a wholly owned subsidiary of Huber SE and is located in Huntersville, NC. Huber was recently recognized in 2011 as one of the 50 fastest growing companies located in Charlotte, NC.

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