Inline Sludge Screens – Municipal and Industrial Applications

As applied in North America
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Abstract

Even where fine screens are installed in the headworks of wastewater treatment plants, some debris will always end up in the sludge. Plastic parts and fibrous materials can severely disturb the operation of thickeners, digesters and dryers. Such solids impair the operation of pumps, heat exchangers, mixers, dewatering systems, pelletizers, etc. Hair and fibers often lead to the formation of tresses and grease balls. Where biosolids are land applied, plastic parts should be removed.

Such undesired solids should be removed from the sludge before causing problems in downstream processes and machines. Grinders might reduce the issues but they do not remove disturbing solids and are high in maintenance. Only screens can effectively remove debris from sludge in industrial processes. Excellent dewatering and compaction of the removed material is a huge advantage because it ensures a clean and safe environment and volume reduction. Sludge screens should be entirely enclosed for odor control.

Keywords
Sludge, screening, inline screen, digester

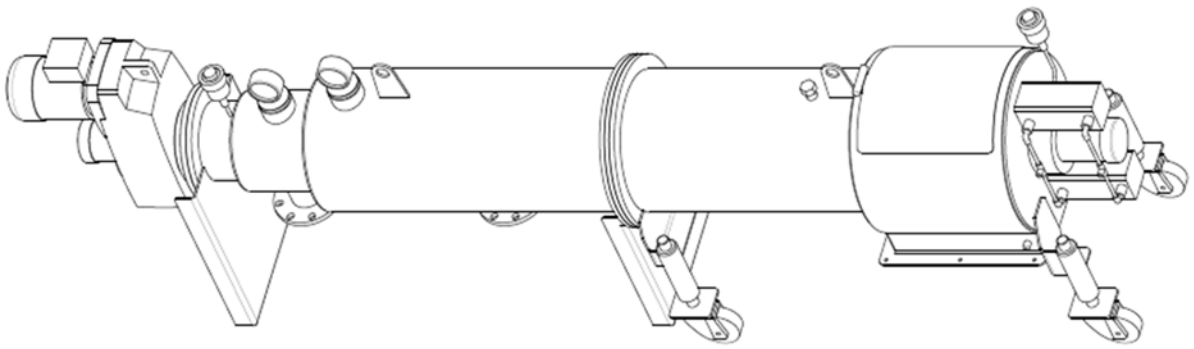
Introduction

In the early 1980s engineers of the Swiss company Picatech-Huber AG invented and developed an inline sludge screen, the Strainpress. The Stainpress is manufactured by Huber SE and in North America is supplied and serviced by Huber Technology, Inc. Of the more than 1,000 Strainpresses which are today installed worldwide, over 100 units are installed in the US.

STRAINPRESS®Sludge Cleaner SP
Sludge is pumped into its perforated tube and flows through the perforations into a casing while debris is retained within the tube. An internal screw pushes the retained screenings along the tube's axis into a conical dewatering and compressing section that is provided with a smaller perforation compared to the screening section.

A pneumatically operated cone, installed at the press zone's discharge end, keeps the discharge opening closed and generates a back pressure. After a screenings plug has formed, preventing sludge flow towards the discharge end, and has been sufficiently pressurized by the screw's movement, it pushes the cone back and some dewatered and compressed screenings are discharged and drop into a container or bag. The screws flights keep the screen clean. No wash water is needed.

The major items of the machine are:
- Pressurized feed (raw sludge)
- Screening section
- Dewatering section
- Pneumatic actuated Cone
- Drive, with power monitoring relay
- Differential pressure: raw sludge - filtrate
- Discharge, moisture sensor



Isometric drawing STRAINPRESS®

The design of the STRAINPRESS® combines:
- easy installation: wastewater treatment plants can be retrofitted easily with the STRAINPRESS®
- hydraulic conditions are less of an issue because system operates as a closed system: pump feed and with low differential
- easy access to the major items of the machine
- keeps the required space for maintenance to a minimum.

The machine can be split at the point where the screening section meets the dewatering section. The piece holding the dewatering section and the discharge housing is mounted to casters and can be easily moved away from the unit. There is literally no additional space required to do maintenance to either the fixed screening section (including the drive unit) or the movable dewatering/discharge section. The required space around the unit is only 28 inch which is less than the walk way required by code (OSHA, 3 ft).

STRAINPRESS® installation, outdoor with frost protection

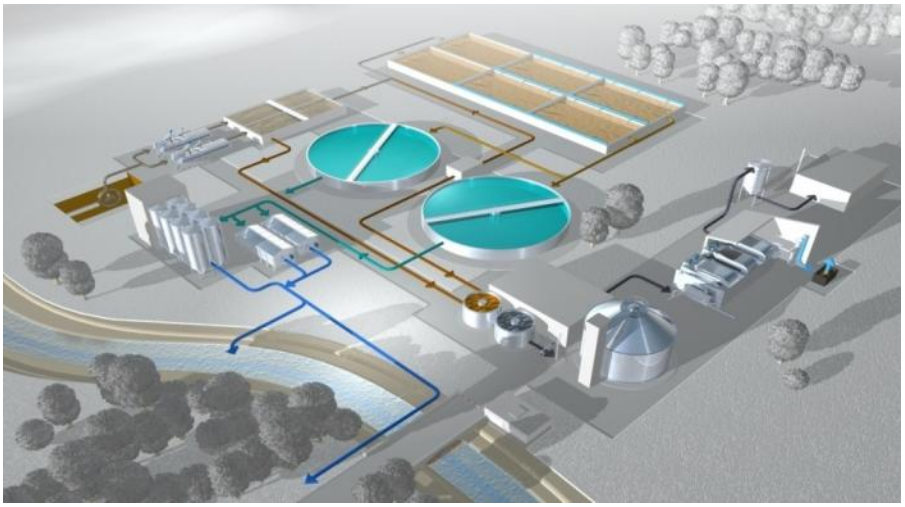
The capacity of the unit is determined by the solid content of the raw sludge and the open surface area of the screening section. The standard screening section for municipal application is made of a 13/64” perforation. The dewatering section consists of a 5/64” perforation.

There is a big variety of screenings and dewatering sections possible. The opening size is selected depending on the application and the material size to be removed from the sludge flow. The perforation range from ½ inch to 3/64” – special screenings and dewatering sections are available: slotted baskets with openings down to 150 micron.

The following general guideline can be given for the capacity of standard municipal applications:

Raw Sludge, solid content [% DS]	Flow Rate [GPM]	Screen combination	Application
1	485	5 – 2	Municipal
3	330	5 – 2	Municipal
4	285	5 – 2	Municipal
5	265	5 – 2	Municipal
6	240	5 – 2	Municipal
7	220	5 – 2	Municipal

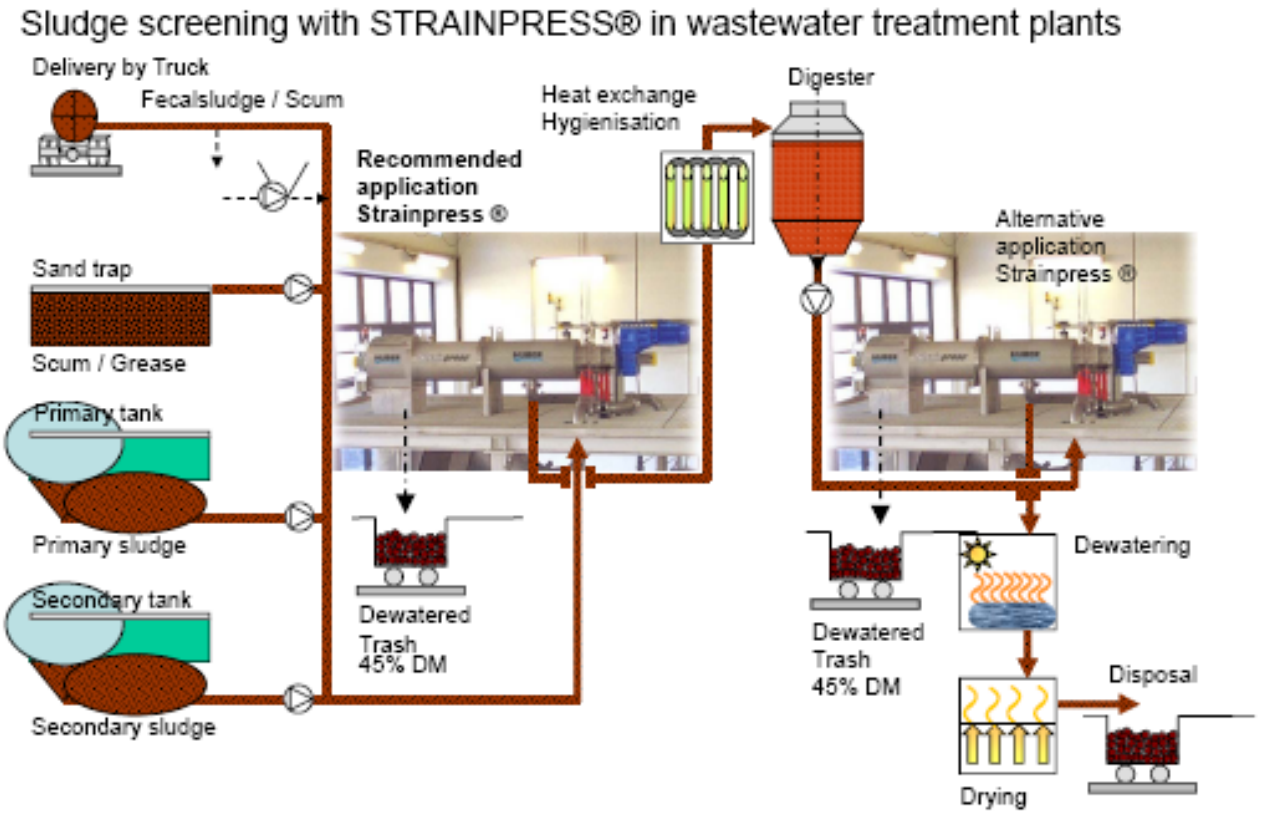
8	150	5 – 2	Municipal



The majority of municipal applications are upstream to the digester. The following illustrations show the locations in the general mass flow of a waste water treatment plant. The second picture summarizes not just the possible municipal applications but it gives also an overview of the performance.

STRAINPRESS application – municipal

The STRAINPRESS® is protecting the digester and auxiliary equipment. It reduces wear and tear to process equipment like pumps, mixers and heat exchangers. The STRAINPRESS® is used in a very tough environment where regular maintenance to the unit is still an integral part. Other reasons for the provision of Strainpresses are: Protection of digesters to prevent scum formation and frequent cleaning, protection of centrifuges from clogging and abrasion, prevention of dryer or pelletizer clogging, land application of biosolids without debris.



Site	Sludge Type	Flow (GPM)	DS Sludge	Head Loss (psi)	DS Screenings	Dry Mass Screenings (lbs/hr)	Reasons
US, plant A	Digested	300 – 400	≈ 3 %	2 – 3	42 – 55 % av. 52 %	≈ 16	Centrifuges + Land Appl.
Canada	Primary + Scum	≤ 260	≈ 5 %	2 – 3	≈ 40 %	≤ 147	Spiral Heat Exchangers + Land Appl.
US, plant B	Primary + Secondary	100 – 420	≈ 5 %	av. 1	40 – 44 % ave. 42 %	90–330	Digesters + Dryers

Results – North America installations

A few North-American results from tests with various kinds of sludge are shown in above as examples. The machine's capacity decreases and its head loss increases with rising solids concentration and sludge viscosity. However, in most applications headloss and power consumption for sludge pumping remain low to moderate. The amount of removed screenings varies widely depending on the amount of debris in the sludge. The dry solids content of the removed screenings is almost always between 35 % and 55 %. The coarser the debris, the higher is this concentration.

Dewatered material, discharged

Paint chip removal with STRAINPRESS®

Industrial Applications

What has been discussed thus far applies to industrial applications, and surprisingly in a huge variety of very different applications. The design requires detailed evaluation of the conditions and a clear understand of the process the STRAINPRESS® is implemented. Every application needs to be evaluated:

- raw sludge, solid content
- particle size distribution
- performance requirements: capture and solids loading rate

The evaluation is needed to determine the process data for the application – mainly the selection of the basket openings (screening and dewatering section).

The overall design of the machine does not require any change (material: sometimes higher grade stainless steel). The instrumentation and controls are identical to any municipal application.

Nevertheless the uniqueness of each application requires testing but as described above, the system can be easily retrofitted in existing systems. The well engineered machine allows the exchange of the screening and dewatering section within “minutes”. Therefore the correct opening can be determined within a day’s of operation.

STRAINPRESS® - APPLICATIONS IN INDUSTRY AND TRIALS								
Industry		**Application between ?**	**Troughpout ca. m3/h**	**Sludge ca. % DS**	**Sieving / Filtration of**	**Screen mm**	**Residues ca. % DS**	**Quantity**
Waste manage-ment company		**HGV + Treatment**	**10 bis 30**	**10 bis 20**	**Impurities of waste oil**	**2 hole**	**45**	**Trials**
		Autoclave + Centrifuge	**5**	**15**	**Impurities of slaughter waste**	**10 hole**	**38**	**2**
		Acceptance + Digestion tower	**5**	**5 bis 20**	**Rejects of fat separator**	**5 hole**	**30**	**Trials**
Airport		**HGV + Neutralization**	**20**	**6**	**Toilet waste from airplanes**	**5 hole**	**45**	**1**
Wood processing		**Cleaning of rin-sing water at board forming machines**	**50**	**0,5**	**Wooden fibers 0,5 - 4mm**	**0,35 x 2 slot**	**50**	**1**
		Recycling of process water	**50**	**0,5**	**Wooden fibers 1 - 10mm**	**0,35 x 4 slot**	**50**	**Trials**
Chemistry		**Paint produc-tionprocess**	**30-45**	**2**	**Agglomerate of paints**	**3 + 5 hole**	**40-50**	**1**
Food		**Waste tank + Fermenter**	**10**	**4**	**Separation of skin from waste of potato-sludge**	**2,5 hole**	**35**	**1**

STRAINPRESS® industrial applications

Removal and dewatering of paper fibers

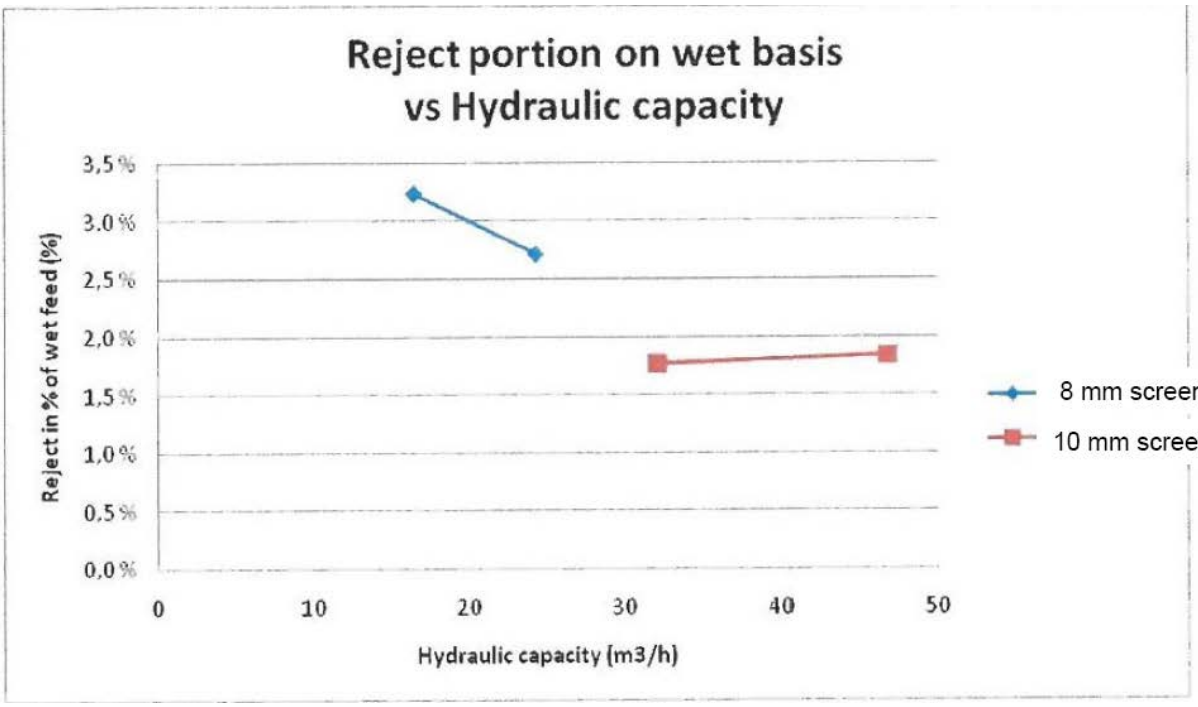
The above list shows that the STRAINPRESS® can be applied to a wide range of applications and the field experience shows it can be done successfully: the possible applications ranges from chemical industry: removal of paint chips, paper mills to food waste processing plants.

Biowaste fermentation – separation of packing material

Food waste treatment is a perfect example of applying the STRAINPRESS® into an existing process because of the need to remove trash and improve the stability of the process. It also is an example how the machine can help to turn “trash” (which means material which was hauled to landfill or incineration) into a valuable product which can be marketed after undergoing additional treatment.

Food waste is a very inhomogeneous material: it always contains a large amount of packing material and plastics. The treatment process consists of several steps prior to the digester – mainly to turn the food waste into slurry which can be treated in the digester. The preliminary steps are removing trash (metal, glass, large plastic) and dissolving material like paper. The digestion processes in place do not have huge problems with this type of material (see figure 14). The product after dewatering of the digested solids are very often limited to landfill or incineration.

The use of the STRAINPRESS® downstream to the digester but prior to the dewatering system (most of the time centrifuges) brings the overall process to the next level. The dewatered material is free of plastic which allows further use: composting e.g.



The optimization process showed that the 5/16" (8 mm) opening has a much higher capture rate compared to the 25/64" (10 mm) opening. This graph indicates also, that the hydraulic capacity is decreasing with the opening size, which is not surprising, but clearly shows the challenge: finding the compromise between capacity and capture rate.

WITHOUT STRAIN PRESS

WITH STRAIN PRESS

These pictures show the difference of the dewatered material after the implementation of the sludge screen. The analysis of the final product shows that more than 80% of the plastic is removed – visually no plastic particles are observed.

Concluding thoughts

Strainpresses minimize debris in sludge and biosolids, but also all kind of industrial applications, they are useful even where fine screens are provided at the headworks. They operate full-automatic, have a low to moderate power consumption and do not need wash water.

Service and maintenance of Strainpresses requires skills and experience. Many machines installed in America have not been well maintained. This should improve now.

Though there is plenty of experience from hundreds of Strainpress applications, pilot testing is still recommended in order to investigate site-specific design and performance parameters especially if the Strainpress is applied to new processes. The paper will present important design parameters determining the design of the Strainpress installation.

Let us help you with your solution today.

Learn more about the **Strainpress®** at http://huber-technology.com

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