January 2009

SLUDGE TREATMENT ENGINEERING

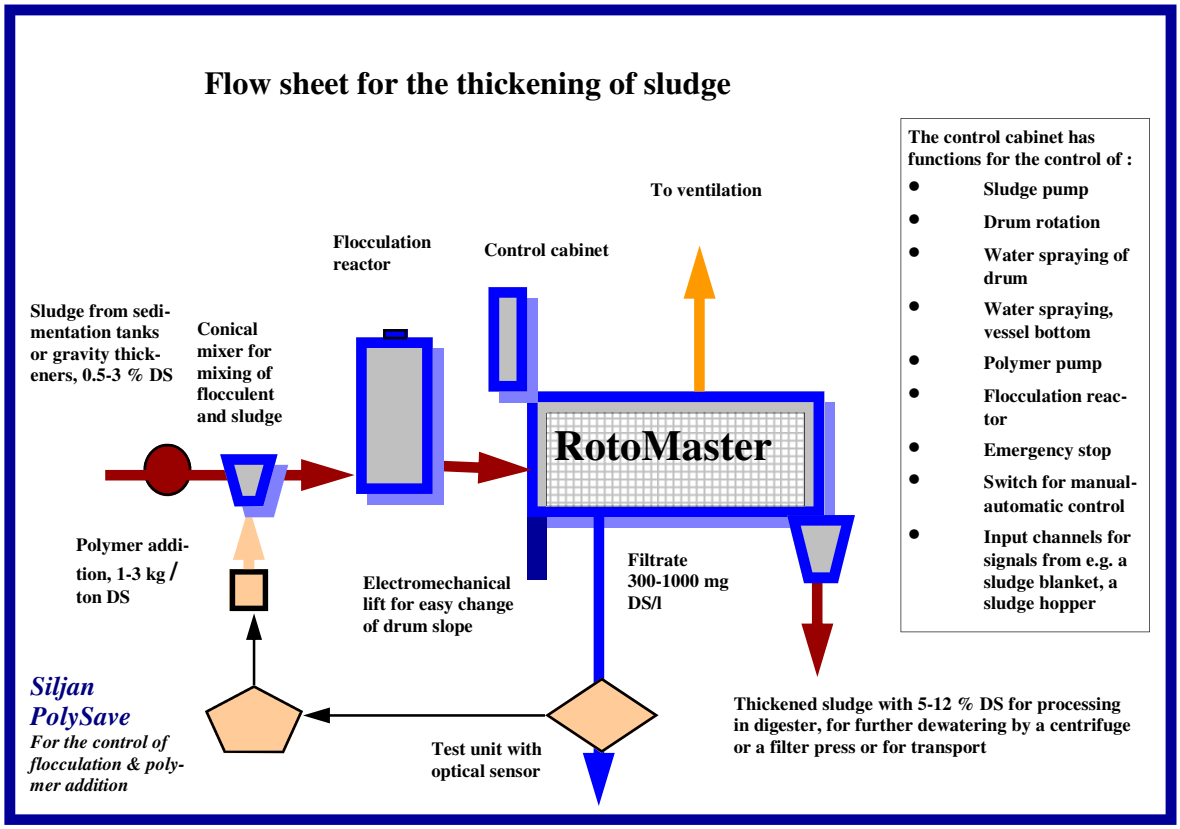
Siljan RotoMaster

Rotary drum thickener for sludge thickening and sludge dewatering

Siljan Allards AB

www.siljanallards.com

The first prototype of the Siljan RotoMaster rotary drum thickener was taken into service in a Swedish sewage treatment plant in 1988; The performance was excellent! Since then some 150 thickeners of this type have been successfully installed in municipal sewage treatment plants, in paper mills, in the chemical and food industry, in Europe, the Middle East and in Asia.
The principle of the function of the Siljan RotoMaster is quite simple; The sludge to be thickened, is flocculated into larger particles using a suitable flocculent, a polymer (poly-electrolyte); The flocculent and the sludge is mixed in a conical mixer and is then allowed to flocculate in a static tubular mixer (smaller machines) or a flocculation reactor (larger machines). The flocculated sludge is then fed into the rotating drum within the drum thickener. This drum is covered by a synthetic filter cloth and is rotated with a speed of about 10 r/min. The water passes the filter cloth while the flocculated sludge particles stays within the drum. In this way, the sludge is thickened to 4-12 % DS.
To keep the filter cloth clean, it is intermittently sprayed with water using certain spray nozzles. In this way, the flocculated sludge is given a very gentle treatment and the consumption of the flocculent is kept on a low level.
The DS content of the thickened sludge is mainly governed by the amount of DS per time unit, fed into the drum, the rate of flocculent addition, the speed of drum rotation and the slope of the drum.



To minimize the consumption of expensive polymer, to more exactly govern the DS-content of the thickened sludge and to minimize the need for operators attention, we have developed a control unit, ***Siljan PolySave***;
Through an optical sensor in contact with the filtrate, Siljan PolySave continuously senses the result of the flocculation and controls the speed of the polymer pump in such a way, that not more than necessary of the expensive polymer is added to the sludge. In this way, the polymer consumption is reduced by 25-50 % depending on conditions.
Siljan PolySave also improves the control of the DS-content of the thickened sludge.
The test unit has a carefully designed cleaning function, which very much increases the reliability of Siljan PolySave.
The control box consists of a small computer unit which is programmed to give an intelligent control of the system and which can be connected to the central control

Picture of the control unit Siljan PolySave, with the test unit, including the sensor, to the left and the computer unit to the right.

Installation of a Siljan RotoMaster is a very profitable investment:

Practical experience as well as economical calculations do show that the installation of a RotoMaster is a very profitable investment, e.g.:

- **Before the digester**, for thickening from DS 0.5-3 % to 6-8 % which results in:
  - **Energy reduction** with up to 6 times for the heating of water in the sludge.
  - Up to 6 times increased residence time, which **increases the gas yield.**
  - Up to 6 times **increased capacity** of the digester.
  - A lowered sludge volume after the digester, **lowers the dewatering costs**.
  - And an **improved process control**.
- Thickening to 6-12 % **before transport and/or deposit**, lowers the trans-portation and/or deposit costs up to 90 %.
- **Before a centrifuge or a belt press**, solves problems with thin sludge and increases the dewatering capacity.
- For the handling of **external sludge**, with a heavily varying DS-content.
- For sieving applications, such as fruit shells and solid particles.

The pay-back time for the installation of a Siljan RotoMaster is often less than 2 years!

Components in a sludge thickening/dewatering system.

The following components can be included in a system delivery:

- **The rotary drum thickener** Siljan RotoMaster in different sizes and capacities.
- **Sludge pumps** of any make, suitable for the application.
- **A unit for polymer addition**, for liquid (small thickeners) or powder polymer.
- **A conical mixer** for mixing polymer and sludge.
- **Siljan PolySave**, a control unit sensing and controlling the flocculation and thickening result. Minimizes the polymer consumption and also the need for operators attention, making continuous thickening easier.
- **A static tubular mixer** to increase the time for flocculation, before the entrance of the sludge into the RotoMaster.
- **A flocculation reactor** designed to give a residence time of a minimum of 1 minute, sludge is stirred for maximum flocculation.
- **A sludge hopper** with a level transmitter, after the RotoMaster but before the pump for thickened sludge.
- **High pressure cleaning** of the filter cloth, for the bigger machines, SF60 and SF120DUO.
- **Pump Control Unit**, including a pressure sensitive level sensor. Designed to handle frequent level variations.

Two drum thickeners Siljan RotoMaster SF 17 installed before a digester

Conical and tubular mixers for mixing and flocculation before sludge thickening

Sludge hopper with level transmitters , after the drum thickener, connected to the pump for thickened sludge

Siljan RotoMaster SF 35 installed in the WWTP of the city of Lund, one of the major cities in the south of Sweden, with 120.000 inhabitants.
Municipal sludge is thickened before the digester.
At bottom left, thin sludge is brought into the thickener through a green flexible pipe, connected to a stainless pipe.

View from the other side; Thin sludge enters the RotoMaster thickener through the pipeline in center, thickened sludge is disposed through the floor (down left) while the filtrate leaves the thickener through the pipeline at the bottom of the picture.

Polymer station, where the polymer used for flocculation enters through the roof and is carefully mixed with water. The 0.1 % polymer-water mixture is then mixed with incoming sludge.

A Siljan RotoMaster SF 3 (the smallest machine, 3 cbm/h) installed in a small WWTP in the middle part of Sweden; On the wall the Siljan Polysave unit, which minimizes the need for attentention of the operator, makes 24 hours operation more reliable and saves expensive polymer.

Conical mixer and static tubular mixer have been installed above the SF 3 thickener, to save space.

3 x Siljan RotoMaster SF 120 drum thickeners installed in the Louyang Chandong WWTP, in China.

The total capacity is 360 cbm/h

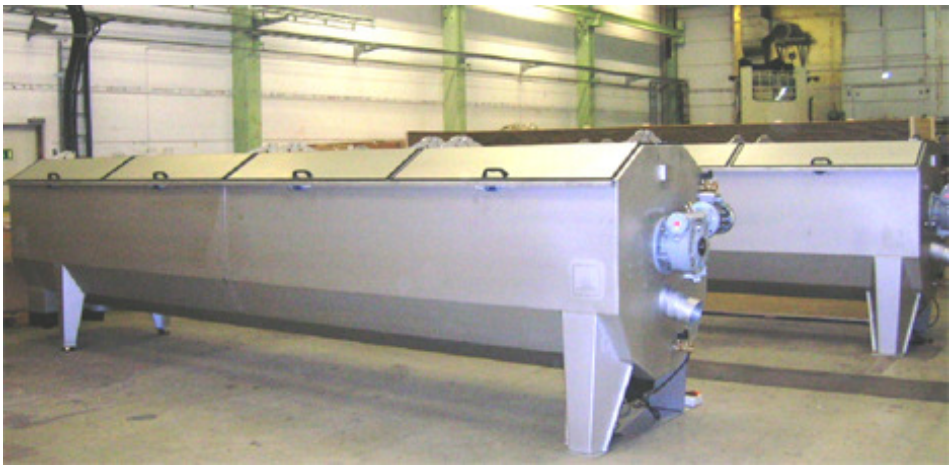
The installation in the Chandong WWTP;

The Siljan RotoMaster SF 120 drum thickeners for the predewatering to about 4 %, Noxon Decanter centrifuges for the final dewatering to > 20 %.

3 x Siljan RotoMaster SF 60 drum thickeners installed in the ZhuZhou WWTP in Hunan, China

One drum thickener Siljan RotoMaster SF 35, at site in Bonnybridge, Scotland.

3 pcs. Drum thickeners SF120DUO, capacity of 120 cbm sludge/hour. Ready for shipment to a Waste water treatment plant in Changsha, China.

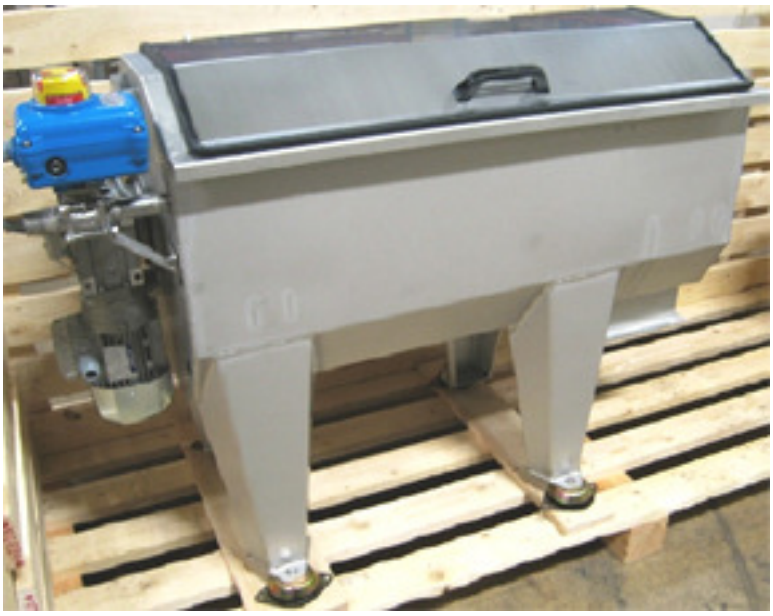


2 pcs. Drum thickeners Siljan RotoMaster SF60. Ready for shipment to a Waste water Treatment Plant in Lithuania.

One piece drum thickener Siljan RotoMaster, installed in a small waste water treatment plant in the archipelago of Stockholm.Static mixers, one Siljan PolySave and one PolyMore-unit was also included in the delivery.

One Siljan RotoMaster SF/, ready for shipment to a small waste water treatment plant in Svenljunga, Sweden.

One piece drum thickener Siljan RotoMaster SF17, delivered to Chile. The customer is very satisfied and they placed an order for an additional machine. The machines are used for sieving within the food processing industry.



The smallest drum thickener, Siljan RotoMaster SF3 (3 cbm/h), ready for delivery to a small waste water treatment plant in Timmersdala, Sweden.

One Siljan RotoMaster SF 7 (7 cbm/h) ready for delivery to the waste water treatment plant in Hyppeln, Sweden.

A very pleased chief operator at Rättviks waste water treatment plant, standing next to their Siljan RotoMaster SF17. The installation was performed in year 1998, to thicken sludge entering a digester. A Siljan PolySave was also installed during year 2000.
The combination Siljan RotoMaster and PolySave gave significant cost savings concerning heating requirement, operators attention and polymer consumption.
A significant increase in gas production was also achieved.

One drum thickener Siljan RotoMaster SF80, Capable of 80 cbm/hour incoming sludge/hour. Ready for shipment to a Waste water Treatment Plant in

One piece of drum thickener Siljan RotoMaster SF3 and one piece of Siljan PolySave, during operation at a small scale Waste water Treatment Plant in southern Sweden.

One piece Siljan RotoMaster SF7, including control cabinet and sludge mixing equipment. Ready for shipment to a Waste water Treatment Plant in Romania.

One Siljan RotoMaster SF 17 (17 cbm/h) ready for delivery to a waste water treatment plant on Öland, Sweden.

1 pc. Drum thickener Siljan RotoMaster SF35, made of AISI 316L, ready for shipment to a Waste water Treatment Plant in Latvia.

1 pc. Flocculation Reactor FR1.0, ready for shipment to a Waste water Treatment Plant in Latvia.

4 pcs Siljan RotoMaster drum thickeners SF60, ready for shipment to a waste water treatment plant in Changsha, PR. of China

Specifications for Siljan RotoMaster

The RotoMaster sludge thickener is available in seven different models with varying capacities:

Model	Capacity m^3/hour	Capacity in kg DS/hour	Length mm	Width mm	Height mm	Weight, empty kg	Power con-sump-tion, kW	Pipe con-nec-tion in/out
SF 3	3-4.5	30-45	1250	650	920	110	0.25	DN60/ 80
SF 7	7-11	70-105	2180	650	920	180	0.37	DN 60/ DN 110
SF 17	17-26	170-255	3225	890	1170	330	0.55	DN 80/ DN 110
SF 35	35-53	350-525	5280	890	1417	990	0.75	DN 10/ DN 150
SF 60	60-90	600-900	6234	1233	1800	1300	1.5	DN 150/ DN 200
SF 120 Duo	120-180	1200-1800	6234	2300	1900	2400	2 x 1.5	DN 150/ DN 300

The capacity given is valid for mixed municipal sludge with 1-1.5 % DS, thickened to 6-8 % DS: When the DS content of the incoming sludge is less than 1 %, or the sludge is thickened to, say 4 % DS instead of 6-8 % DS, the capacity in cbm/hour is larger.

Materials of construction:

Stainless steel of type AISI 304 is the standard material for this machine. 10 years of experience has proven that in municipal sewage treatment plants, this material has an excellent corrosion resistance.

At increased chloride content, increased temperature and/or the presence of acids, a stainless steel of type AISI 316 or better is needed. We are experts in materials selection and can make a reliable judgment based on the water composition.

The shaft bearings and the filter cloth are made in synthetic materials while the spray nozzles normally are made in brass.

For pulp & paper applications, all metallic material in contact with the sludge is made in AISI 316 stainless steel.

Motor drives: 3-phase asynchronous motors according to IEC-standard

Electrical connections: 3x220/380 V voltage

Auxiliary equipment:

Siljan PolySave including test unit/sensor:
Protection class IP65; Is manufactured in stainless steel and synthetic material.

Control cabinet: Protection class IP 54; Is made in stainless steel.

Conical mixer: Stainless steel.

Tubular mixer: Stainless steel.

Flocculation reactor: Stainless steel.

Sludge hopper: Is made in stainless steel.

Air stirring system: Eliminates the separation of thickened sludge in the holding tank before the digester in a thicker and a thinner part.

High pressure cleaning: Of the filter cloth, for the bigger machines, SF60 and SF120DUO.

Pump Control Unit: Including a pressure sensitive level sensor. Designed to handle frequent level variations.

Installation: All models have a compact design and needs limited space.
Pipe connections as well as electrical connections are defined above.
Thus, the installation of the RotoMaster and the auxiliary machinery, including startup can be made in a few days,
including training of operators.

Contact us for more technical/economical information or a quotation.

Siljan Allards AB

Brändavägen, SE-79532 Rättvik, Sweden; Tel: +46 248 12535; Fax: +46 248 13785

E-mail: info@siljanallards.com; Web site: **www.siljanallards.com**