

# Screw Conveyors

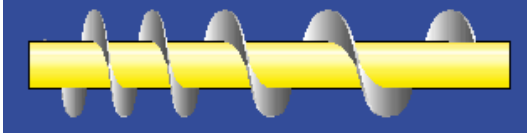
## Shafted

or

## Centerless (Spiral)

The following is a general discussion of the two main types of screw conveyors used in wastewater and water treatment plants. The intent is to provide some general guidelines to the type conveyor for the application and design parameters.

Shafted Conveyors



### 1. General:

Shafted conveyors have a high initial cost but a lower cost for spare parts and maintenance.

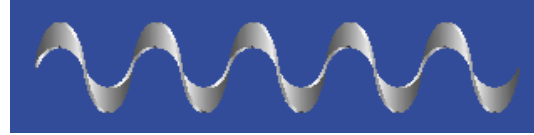
### 2. Transported materials:

- Dewatered (sludge) biosolids.  
[Not above 45% dry solids]
- Secondary screenings.
- Grit.
- Cross collectors.  
[Preferred]
- Scum.
- Alum sludge's.  
[Preferred]
- Thickened sludge's.  
[Preferred]
- Metal Hydroxides sludge's.  
[Preferred]
- Free flowing dry materials.  
[Preferred] Will not degrade the product

Long runs of shafted conveyors with high rpm's can change the sludge characteristic by liberating water contained in the sludge, making it pasty.

This is mitigated by lowering the speed of the conveyor to a maximum of 40 rpm.

## Centerless Conveyors



### 1. General:

Centerless conveyors have a lower initial cost but a higher cost for spare parts and maintenance.

### 2. Transported materials:

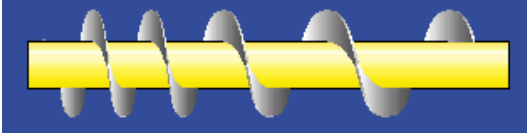
- Dewatered (sludge) biosolids.  
[Not below 12% dry solids]
- Secondary screenings.
- Primary Screenings.  
[Preferred]
- Grit.  
[Preferred]
- Cross collectors.
- Scum.
- Garbage.  
[Preferred]
- Abattoirs

In general, a centerless conveyor is one size smaller than a shafted conveyor as there is no center tube.

Limited filling degree of 20% with a speed of:

- Sludge                    20 rpm
- Screenings            12 rpm
- Grit                        7 rpm

## Shafted Conveyors



### 3. Design considerations

Shafted conveyors longer than 10 feet may require an intermediate bearing.

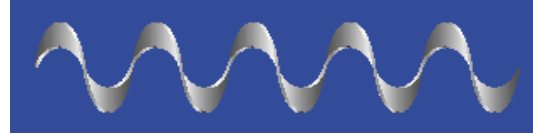
The bearing with the longest life expectancy in the municipal market is a roller bearing with mechanical seals, a grease lubrication system, and a flexible coupling.

A roller bearing type intermediate bearing can be replaced in two to three hours compared with significantly longer time to replace centerless conveyor wear liner

Increase availability of the conveyor.

Fewer operating restrictions.

Centerless Conveyors



### 3. Design considerations

A centerless conveyor or sections of the conveyor **cannot be run dry** for extended periods of time.

Operating a centerless conveyor without material [**dry**] will increase the wear of the spiral flight and wear liners.

Water in the material being transported performs several important functions:

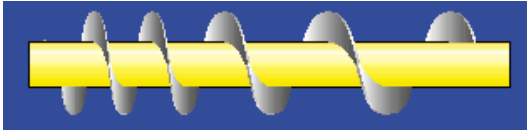
- acts as a lubricant between the wear liner and spiral flight and reduces friction.
- keeps the wear liners cool. If the conveyor is operated without material the friction between the wear liners and the spiral flight will cause the liners to increase in temperature. As the wear liners get warmer the plastic wear liners get softer resulting in increased wear.

If one section of the conveyor's wear liner becomes worn, the complete conveyor would have to be relined.

Dry running of centerless conveyors occurs most when the system includes one of the following:

- more than one dewatering machine.
- multiple discharge points on the conveyor such as truck or container loading.
- systems having more than one point of disposal to down stream systems such as drying, truck loading, or incineration.

Shafted Conveyors



### 3. Cost comparison:

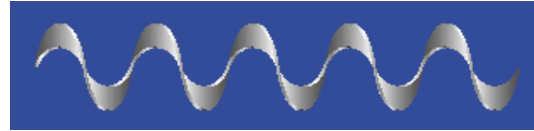
Shafted conveyors have a higher initial cost but have a lower maintenance cost over a four year period.

- Electric motors and speed reducers would be the same for both conveyors types.
- Replacement parts include hanger bearings if required due to conveyor length.
- Maintenance work includes lubrication of bearings and maintain intermediate bearing lubricators.
- Lower service labor cost.

As hanger bearings are the only wear components in a shafted conveyor, reduced maintenance time will increase the availability of the conveyor and, more importantly, the associated dewatering or screening equipment.

After two to three years of normal operation, the evaluated cost of a centerless conveyor would be **equal** to that of a shafted conveyor. After that, the shafted conveyor would become the lowest cost option.

Centerless Conveyors



### 3. Cost comparison:

Centerless conveyors have a lower initial cost but higher maintenance cost and service requirements over a four year period.

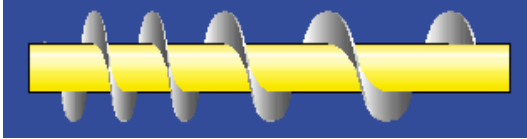
- Electric motors and speed reducers would be the same for both conveyors types.
- Replacing wear liners.
- Replacing spirals.
- Higher service labor cost.
- Operating restriction.

Wear liners and spiral flights are replaced as part of regular maintenance. The period of time a conveyor is out of service will also stop the associated process.

The operation of primary screens and associated screening conveyor is normally intermittent. The reduced operation time of the conveyor will reduce the maintenance requirements for the conveyors, making them the preferred type of conveyor for this application.

If a process system cannot be out of service for lengthy periods of time, we would recommend either dual lines of conveyors or an alternate means of bypassing the conveyors be provided.

Shafted



#### 4. Types of conveyors:

**Horizontal conveyor:**

Unlimited length.

Multiple flight configurations, which can be mounted on a single shaft (single drive) including bi-directional flights.

**Inclined conveyors:**

Up to 30° from the horizontal.

**Vertical conveyor:**

Can lift 45 feet in a single lift.

When the conveyor system is stopped, material in a shafted vertical conveyor will be discharged leaving the conveyor empty.

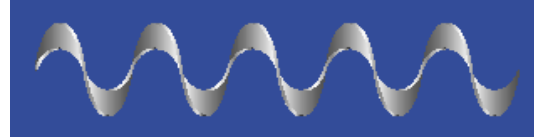
**Live Bottom conveyors:**

Can be provided in single or multiple flights with independent drives for each flight or a single drive assembly.

The conveyors can be designed as non-clogging self-cleaning, in which case the flight would have to be synchronize with timing gears.

If rate of material being retrieved from storage is of importance, then flow control devices would be required. The quantity of material being retrieved from a hopper, bin, or silo can vary widely because of the height of stored material and the varying percentage of dry solids.

## Centerless Conveyors



#### 4. Types of conveyors:

**Horizontal conveyor:**

Length is limited by the diameter of the conveyor and whether the spiral flights are equipped with an insert.

Bi-directional flights are possible.

**Inclined conveyors:**

Up to 30° from the horizontal with spiral hold down devices.

**Vertical conveyors:**

Can lift 45 feet in a single lift.

Vertical centerless conveyors store material in the conveyor [in the central area where there are no flights]. This stored material can contaminate new material when it is conveyed through the conveyor.

When the conveyor system is stopped, material in a centerless vertical conveyor will remain in the conveyor as this type conveyor cannot empty itself.

**Live bottom conveyor:**

The rate of retrieval from a hopper, bin, or silo will vary greatly with a centerless conveyor. This is due to the central opening in the spiral flight, which permits material to pass through the conveyor uncontrolled.

Centerless conveyors are most suited for small hoppers, bins, and truck loading where the filling rate is not critical.

## Shafted



## 5. Manufacture

There are numerous CEMA conveyor manufacturers in North America, of which only a few would be capable of manufacturing a conveyor to the requirements of a BioSec specification.

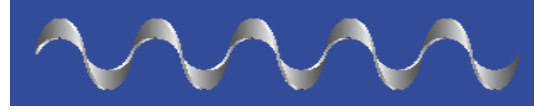
BioSec conveyors are specifically designed for the wastewater and water application. **The BioSec specification incorporates the essential design requirements for dewatered sludge conveyors.**

These requirements are substantially superior to those of a standard CEMA conveyor which are designed to transport dry, free flowing material.

The shafted conveyor market has become more competitive, but we still see many good opportunities, particularly if we can **work with the engineer during the design stage of a project.**

Working with the engineer will ensure the design is correct; the specification includes the necessary information for the conveyors so that competition would have to build to a BioSec standard, rather than to a lesser standard.

Centerless Conveyors



## 5. Manufacture

There are many companies offering centerless conveyors as one of its main product lines with a few companies offering centerless conveyors in conjunction with their other equipment, such as screens.

The centerless conveyor market has become very competitive and we note a tendency towards the supply of standard units with even lower cost.

- Grit Classifiers
- Screenings washer compactors.

The large number of companies offering centerless conveyors has resulted in a highly competitive market with lower pricing for equipment.

Specifying the BioSec/ML screen with a centerless conveyor as a single source supplier would reduce the overall cost of the equipment.

Shafted



## 6. Special conveyors

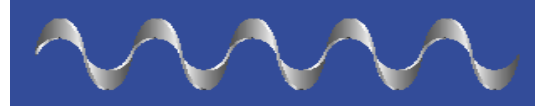
### **Centrifuge classifying conveyor.** [see separate description].

This type of conveyor will eliminate the need for slide gates or a diverter chute below a centrifuge and eliminate the problem of determining when the gate should be moved and the dewatered cake be directed to the conveyor.

An additional advantage of this conveyor is if the centrifuge loses the sludge seal during operation, (e.g. loss of polymer) the non-dewatered sludge would go directly to drain without the operator taking action. This conveyor prevents non-dewatered sludge being transported to the sludge storage area and contaminating the stored material.

### **Centrifuge dewatering and thickening classifying conveyor:**

Another variation of this conveyor is for centrifuges that are used both for dewatering or thickening operations. The classifying conveyor would direct the material to the appropriate location, while retaining the advantages of the classifying conveyor.



## 6. Special conveyors

### **Centrifuge classifying conveyor.** [See separate description].

This has been provided in a centerless design but has limitations, particularly if there is the potential of running the conveyor dry [below the inlet chute]

This type of conveyor will eliminate the need for slide gates or a diverter chute and the problem of transporting wet material to the system or plugging of drains.

An additional advantage of this conveyor is if a centrifuge loses the sludge seal during operation, [loss of polymer] the non-dewatered sludge would go directly to drain. This conveyor prevents non-dewatered sludge being transported to the sludge storage area and contaminating the stored material.