

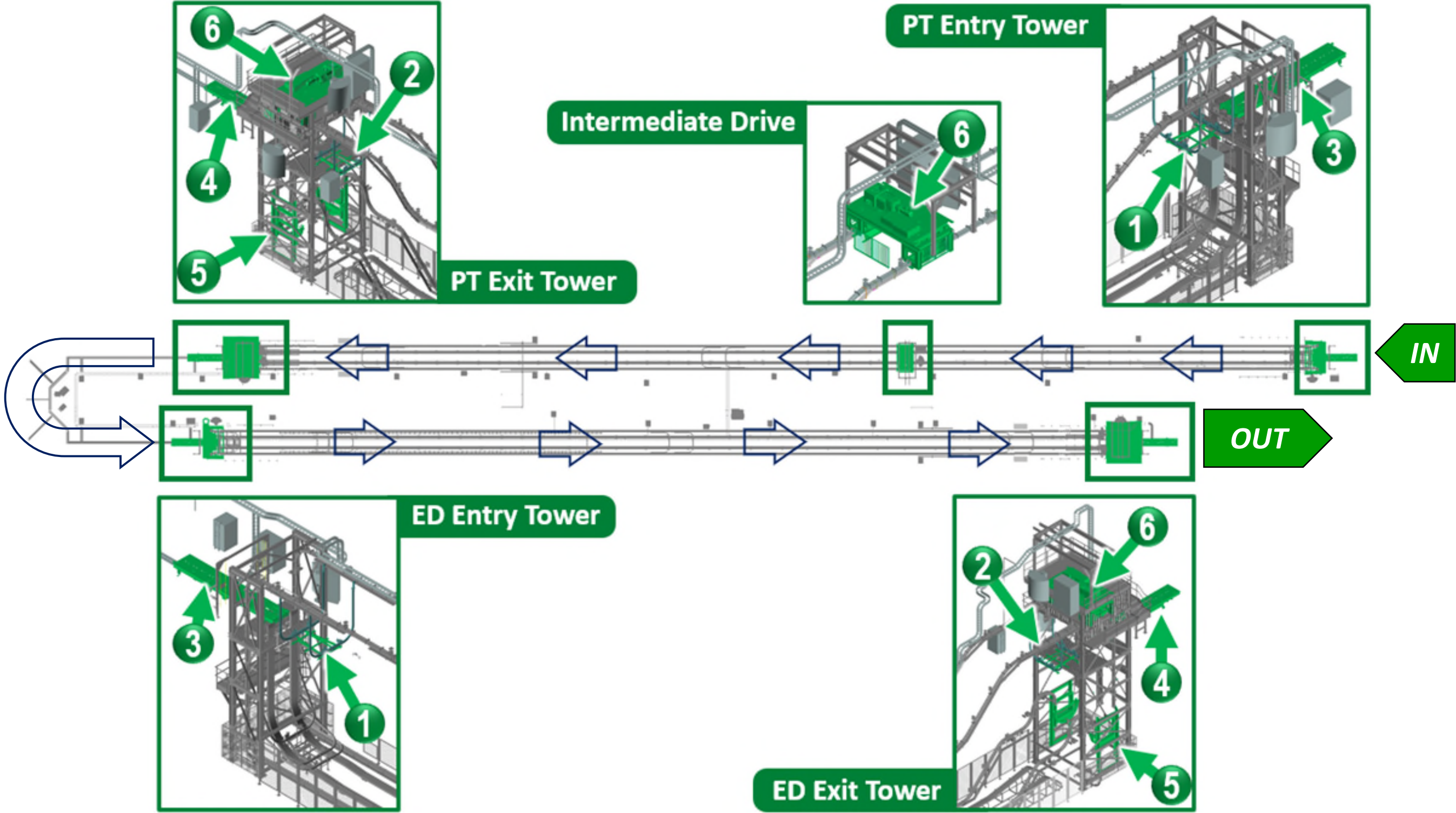
PTED Pendulum System - Components

Your Pendulum Conveyor System is used for both **Phosphate Treatment (PT)** and **Electro-Coating Dip (ED)** processes and contains the following major components:

- *Pendulum Inlet & Outlet Tables*
- *Pendulum Chain*
- *Pendulum Drive Assembly*
- *Pendulum Take-Up*
- *Pendulum Chain & Pins*
- *Penduls*



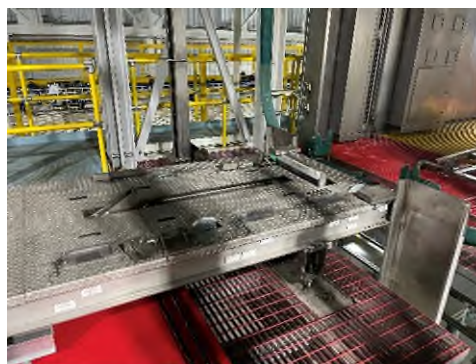
Pendulum System Layout



Pendulum System Walkthrough

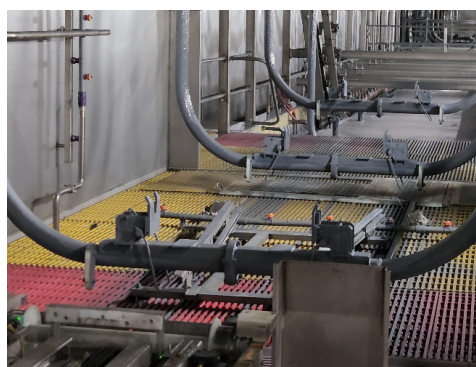
Entry into Pendulum Conveyor

The skid with the secured body travels to the **Inlet Table** to prepare for entry into the Pendulum Conveyor. This specially modified Power Roll Bed is designed with an indexer that ensures that the skid is accurately positioned to be picked up by the hanging Penduls, minimizing the risk of misalignment or errors during transfer.



Securing Skid to Penduls

After the skid is picked up by the Penduls, it is secured by a pair of **Skid Locking Devices** mounted at the base of each Pendul. These locking devices are crucial for maintaining the integrity of the transportation process. These locking devices ensure that the skid will not be separated from the Pendul during its travel through the Pendulum Conveyor.



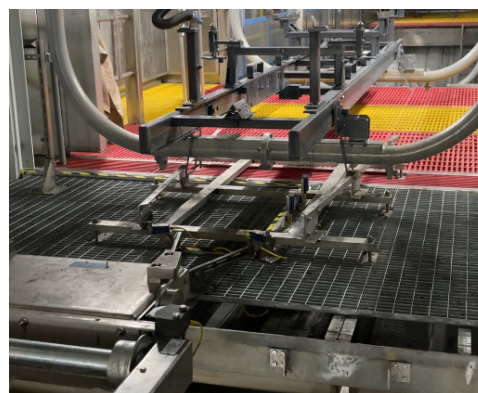
Traveling through Process

Once the skid successfully transfers to the Pendulum Conveyor, the next critical step in preparing the body for subsequent stages is the **Phosphate Treatment (PT)**. This involves fully submerging the body through a series of fluid-filled dip tanks, designed to clean and prepare the surface for coating.



Unlocking of Skid from Penduls

After the Pretreatment process is complete, the skid unlocks from the Penduls as the **Skid Unlocking Devices** engage with the floor actuator. Once all four are unlocked, the skid is no longer secured to the Penduls and is ready for transfer to the Roller Bed conveyor.



Ensuring Proper Disengagement

The skid is transferred to the **Outlet Table**. This is a typical Wet Application Power Roll Bed with extra sensors to ensure proper disengagement from the Pendul.



Process Repeats for 2nd Pendulum Conveyor

The skid then travels to a second Pendulum Conveyor, following the same steps from loading to unloading to complete the **Electro-Coating Dip (ED)** process.

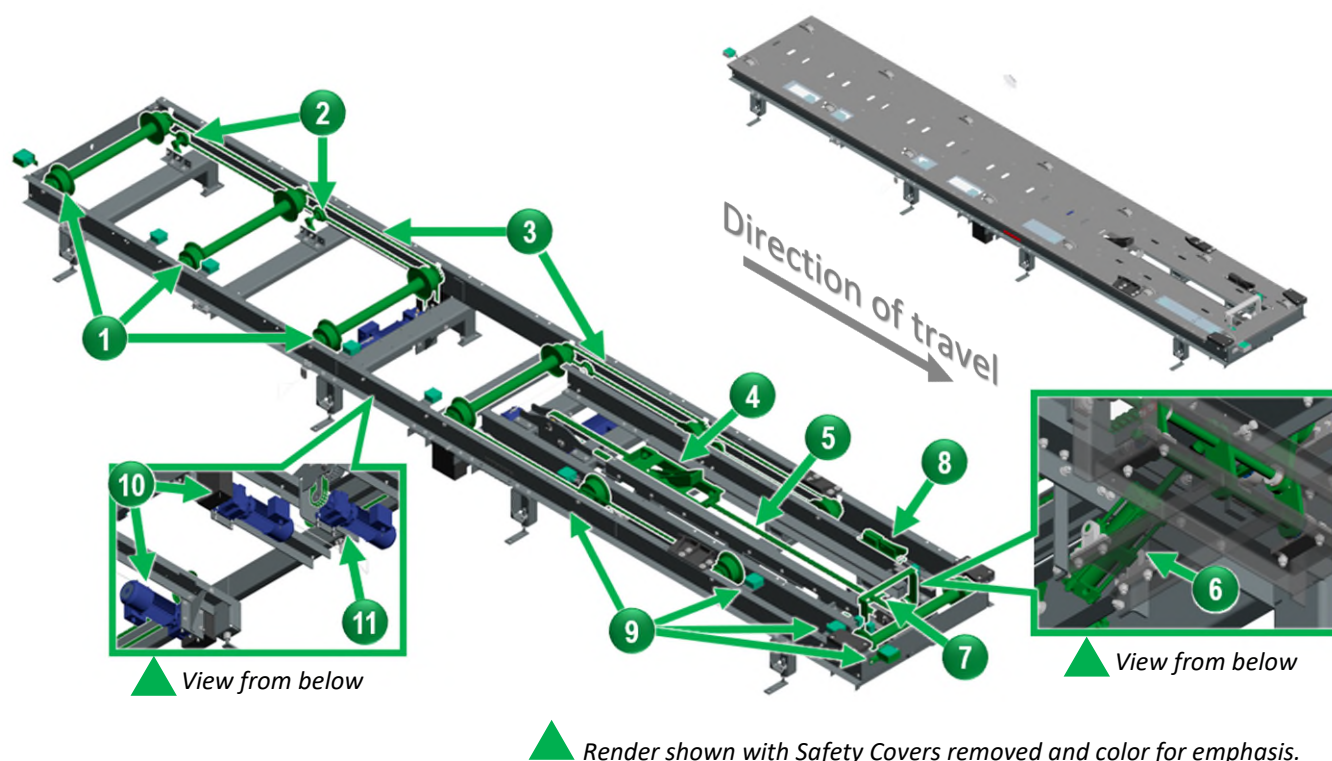


Exit Pendulum System and Enter Next Process

After exiting the Pendulum Conveyor, the skid travels to the next process in the Paint Shop.



Pendulum Inlet Table


1

Rollers

5

Skid Pusher Chain

9

Proximity Switches

2

Chain Tensioners

6

Skid Stop Air Cylinder

10

Power Roll Bed Gearmotor

3

Power Roll Bed Chain

7

Skid Stop

11

Pusher Gearmotor

4

Skid Pusher

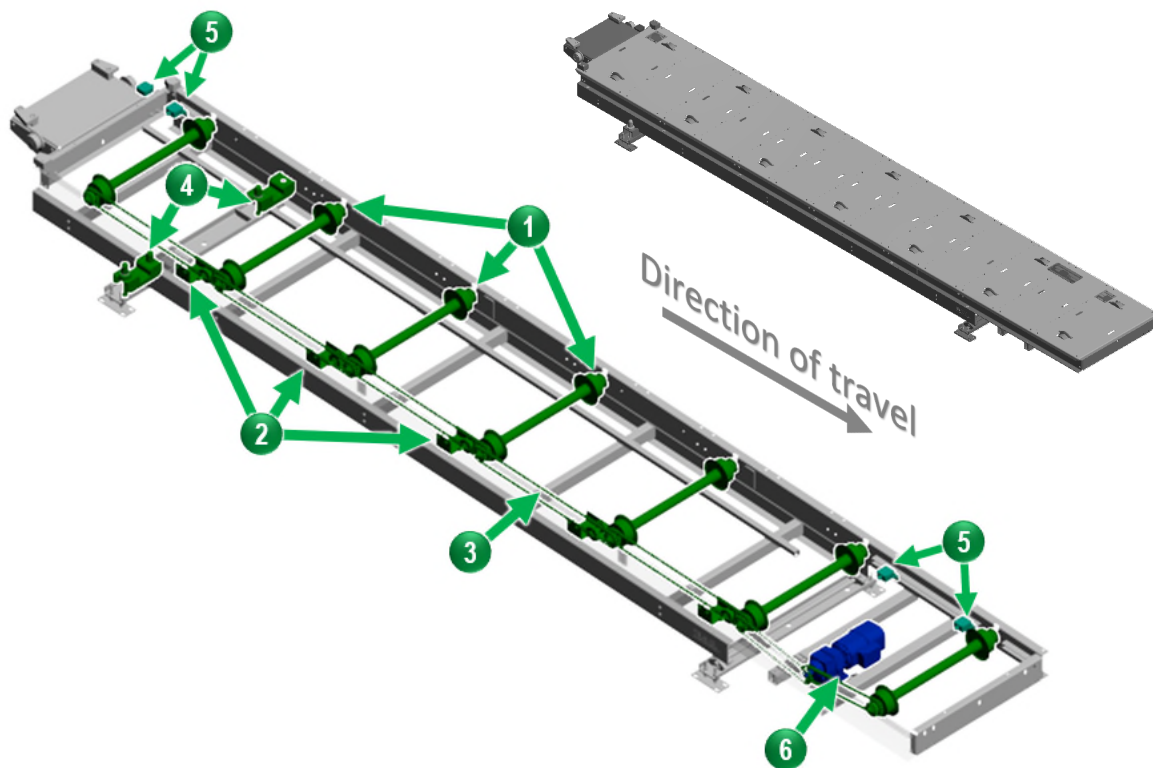
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Anti-Backup

Pendulum Inlet Table Overview

The Pendulum Conveyor Inlet Table is designed to feed skids to the Pendulum Conveyor so they can be properly picked up by the Pendul. This special Power Roll Bed is designed for wet area conditions and therefore the rollers are chain driven and the table has a stainless steel top cover plate. Skid staging to the Pendulum Conveyor is effected by moving the lead end of the skid into position for engagement with a Pendul. This is done by the rollers of the table. Final staging is accomplished through the use of a pusher mechanism that is located near the discharge end of the inlet table. Skid movement on the inlet table is controlled by the PLC in the local control panel. The PLC receives information from input devices located on both the inlet table and the Pendulum Conveyor.

Pendulum Outlet Table



▲ Render shown with Safety Covers removed, side frame transparent, and color for emphasis.

- | | | |
|---------------------------|---------------------|-----------------------------|
| 1 Rollers | 3 Chain | 5 Proximity Switches |
| 2 Chain Tensioners | 4 Transducer | 6 Gearmotor |

Pendulum Outlet Table Overview

The Pendulum Conveyor Outlet Table is designed to receive skids as they are dropped off by the Pendul. From the Pendulum Conveyor they will be transferred into the Roller Bed conveyor system.

The table looks like a standard wet area Power Roll Bed, but there are a couple key differences. At the infeed of the table, there are four spring mounts – two on each side. These spring mounts absorb the shock of the skids should they fail to detach properly from the Pendul. On top of the springs are transducers that can detect a spike in pressure should a skid land directly on the table. Additionally, there is a diving board present immediately before the table. This board has a spring device that will shut down the system should something land on it.

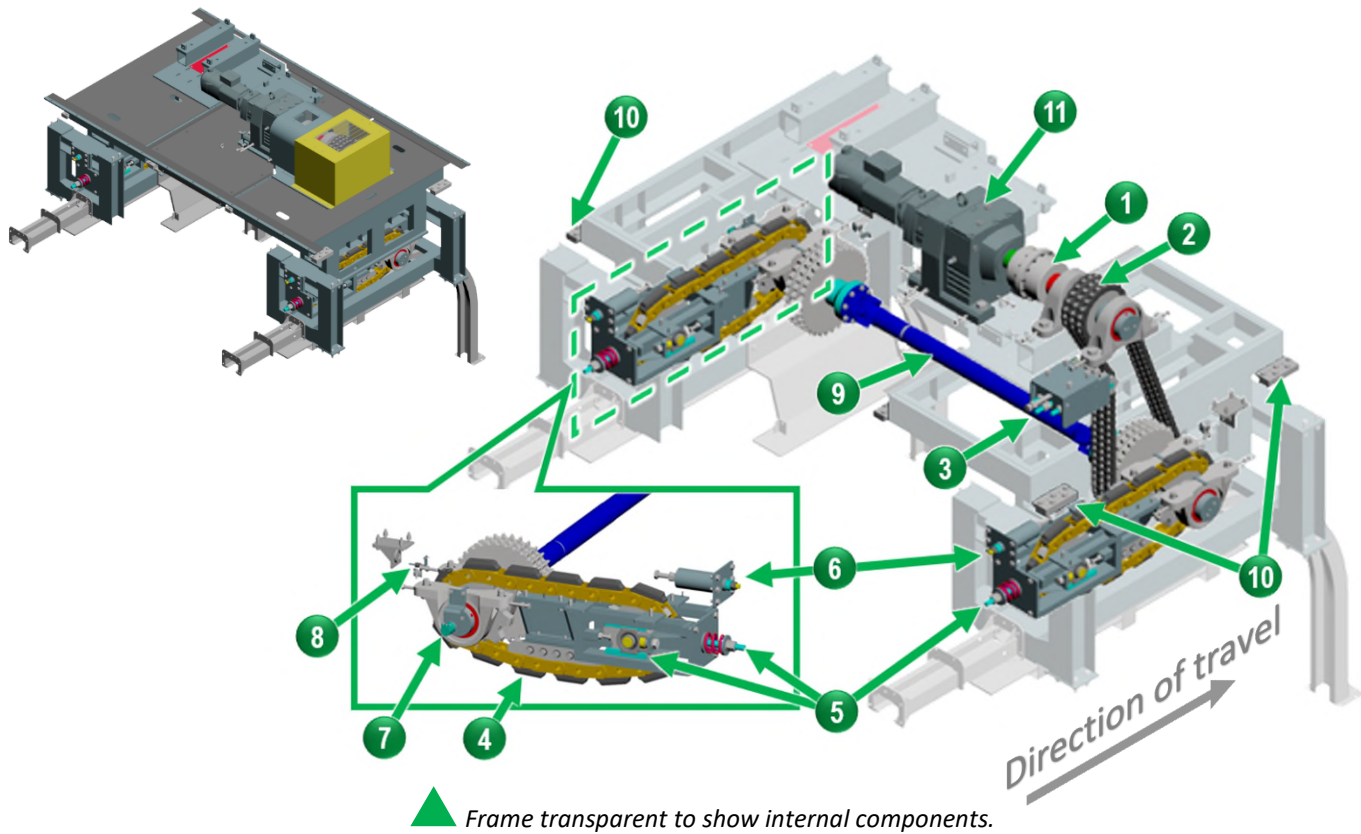
At the gearmotor end, the table mounts to the floor with a pivot mount. This allows the vertical travel needed at the other end of the table for the springs.

System Components | 6



▲ Skid transfer from Pendul to outlet table.

Pendulum Drive Assembly


1

Coupling

5

Caterpillar Take-Up

9

Cardan Shaft

2

Triple Chain Loop

6

Torque Overload Spring

10

Gib

3

 Drive Chain Spring
Tensioner

7

Encoder

11

Gearmotor

4

Caterpillar Chain

8

Torque Overload Sensor

Pendulum Drive Overview

The caterpillar drive assembly of the Pendulum Conveyor pulls the chains for the PTED Pendulum System.

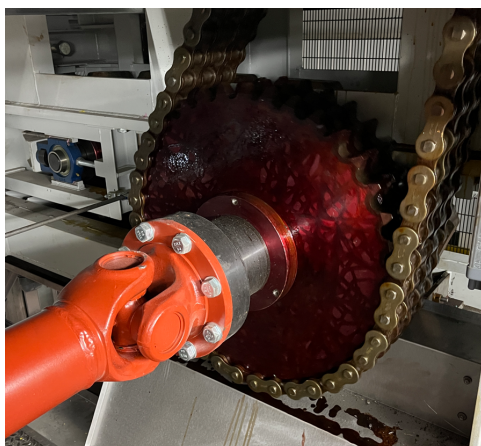
Each caterpillar drive assembly has one 10hp SEW gearmotor engaged and uses a coupling to drive the motor sprocket and ultimately drives the conveyor chain.

The motor sprocket drives a triple chain loop that powers a drive sprocket. A drive chain spring tensioner maintains tension for the triple chain. A cardan shaft transmits power to the drive sprocket on the other side of the drive assembly. These drive sprockets in turn power the caterpillar drive sprockets that pull the caterpillar chains on each side.

One drive assembly is installed each Exit Tower for both the Phosphate Treatment (PT) and Electro-Coating Dip (ED) stages. An additional intermediate drive is also located near the mid-point of the PT track.



▲ Drive Assembly for PTED System at Scout



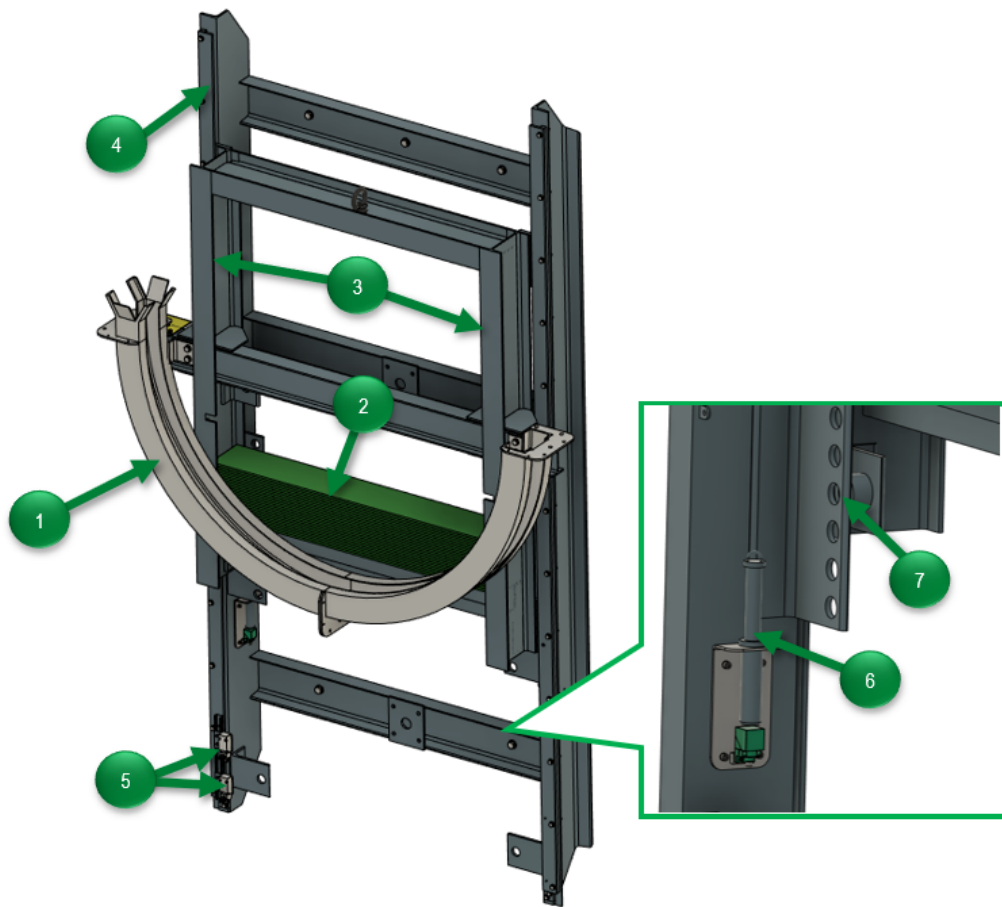
▲ Lower Caterpillar Drive Assembly – Cardan Shaft and Drive Sprocket

The caterpillar chain pulls the conveyor chain that is riding in the chain track. At the other end of the caterpillar chain loop is a caterpillar take-up sprocket that maintains caterpillar chain tension.

There are a number of controls on the drive assembly:

- Rotary encoder on one of the caterpillar motor sprockets to monitor conveyor chain speed.
- Proximity sensors at each drive unit to inform the controls system which drive unit is engaged/dis-engaged.
- Proximity sensor that determines an over-torque situation on each caterpillar drive frame.
- Vibration sensor on each gearmotor for future predictive preventive maintenance functionality.

Pendulum Take-Up



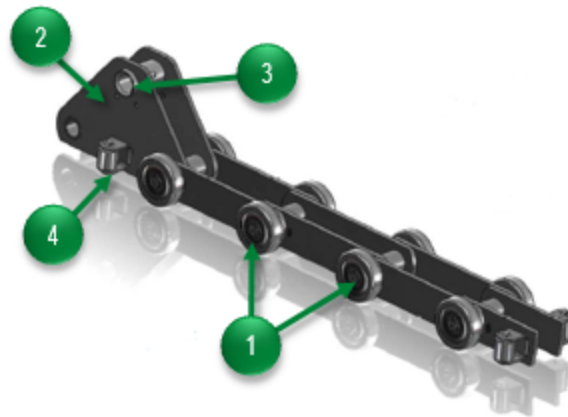
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|-------------------------------|---------------------------------|----------------------------|
| 1 Floating Chain Track | 4 Slide Mount Track | 7 Lock-Out Pin Slot |
| 2 Counter Weights | 5 Take-Up Sensors | |
| 3 Slide Mount | 6 Monitored Lock-Out Pin | |

Pendulum Take-Up Overview

As the Pendulum System operates in picking up skids with the Penduls, dipping the skid in and out of the bath, and then unloading skids from the Penduls, the load on the conveyor chains varies. To maintain a relatively constant load on the conveyor chains, and to serve as a “shock” absorber, the Pendulum uses a gravity take-up for both chains. These take-ups are on the sides in the lower half of the drive/take-up tower.

Each take-up is made up of a floating chain track that connects to a series of weights, which in turn connects to a slide mount. The slide mount rides on a track that is fixed to the drive/take-up tower structure.

Pendulum Chain



1 Roller Pins

3 Pendul Mount

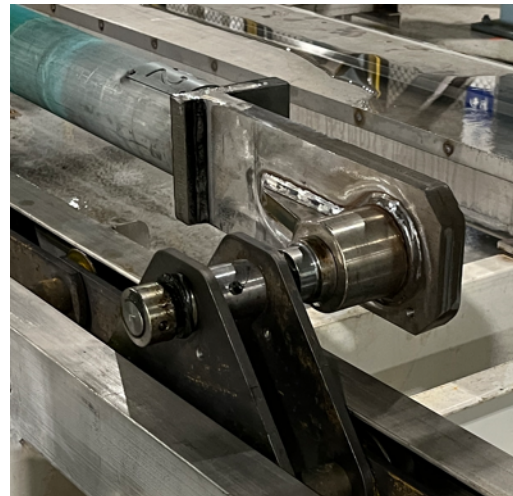
2 First Link

4 Side Guide Rollers

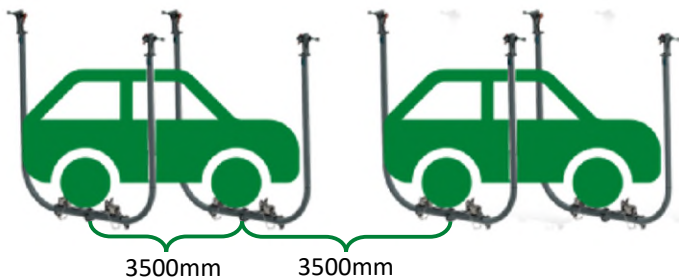
Pendulum Chain Overview

Two sets of Pendulum chains ride on the track for each Pendulum System – one for each side of the Pendul. One pitch of the pendulum chain allows two Penduls to be mounted – one Pendul per 3500mm chain segment – followed by a space of 3500mm before the next Pendul set, totaling 7000mm. Each segment is made up of links of varying types that are all connected with roller pins that ride on the conveyor chain track.

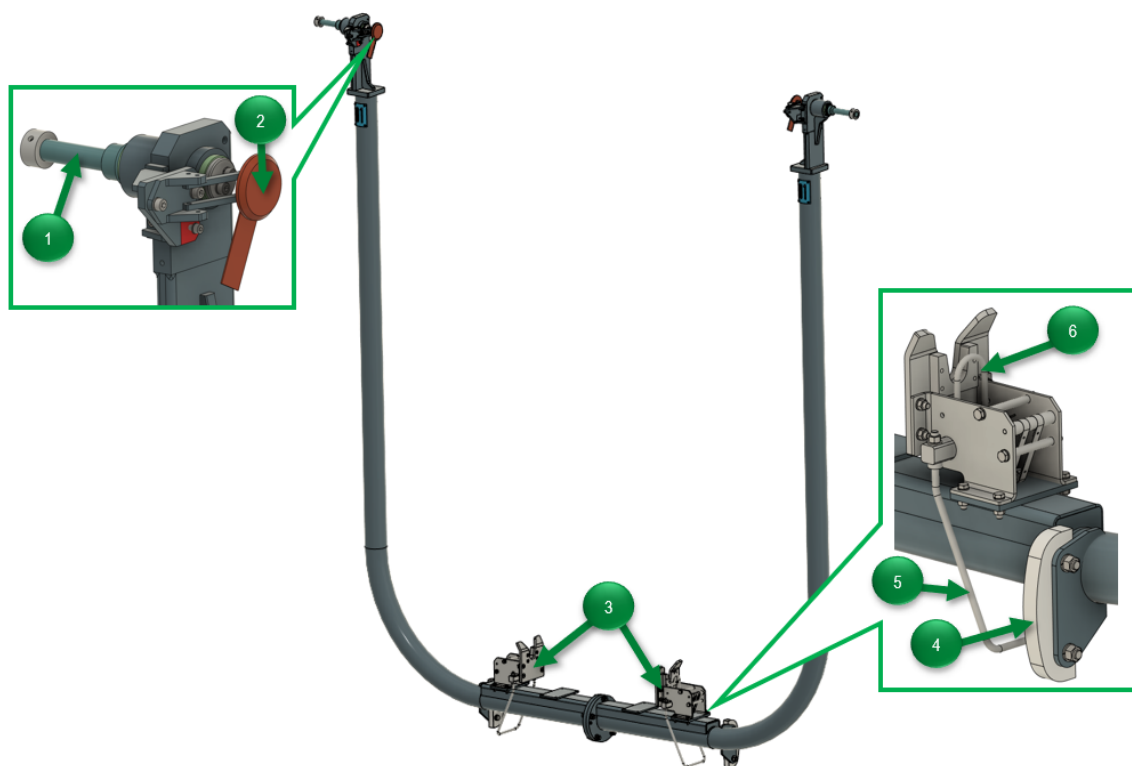
The first link of a segment is triangular when viewed from the side. This link is where one end of a Pendul mounts and has side guide rollers to keep the conveyor chain centered in the track. The remaining links are like a standard chain link except that every fourth link has side guide rollers.



▲ Pendulum Chain with a mounted pendul.



Penduls


1

Conveyor Chain Attachment (Pins)

3

Skid-Locking Mechanism

5

Latch Arm

2

Current Collector*

4

Wear Pad

6

Skid Lock

* Current collectors are only installed in Electro-Coating Dip (ED) Pendulum Systems.

Pendul Overview

The U-shaped Pendul assembly carries one end of the skid as it travels through the baths – two Penduls will carry an entire skid: front and rear. At the tips of the “U” is where the Pendul attaches to the conveyor chain. The front and rear Pendul function similarly, however, can be differentiated at their attachment pin locations. On the Pendul for the front of the skid, there are a pair of pins at the tips to identify that this is the Pendul for the front of the skid. At the tips of the rear Penduls, current collectors may be mounted that electrically grounds the skid and the vehicle body that it is carrying. Current collectors are only necessary for E-Coat systems.

At the base of the Pendul are two skid-locking mechanisms. These mechanisms latch onto a pin on the side of the skid to ensure it is secure. This is important so that it does not come off the Pendul when it is dipped into bath tanks. The latch arm can be changed to one of two positions: outward (locked) or inward (unlocked). A floor-mounted actuator is installed at the entry and exit of the Pendulum booths and changes the position of latch from the skid-locking mechanism.



▲ Skid-Locking Mechanism in Locked position.