

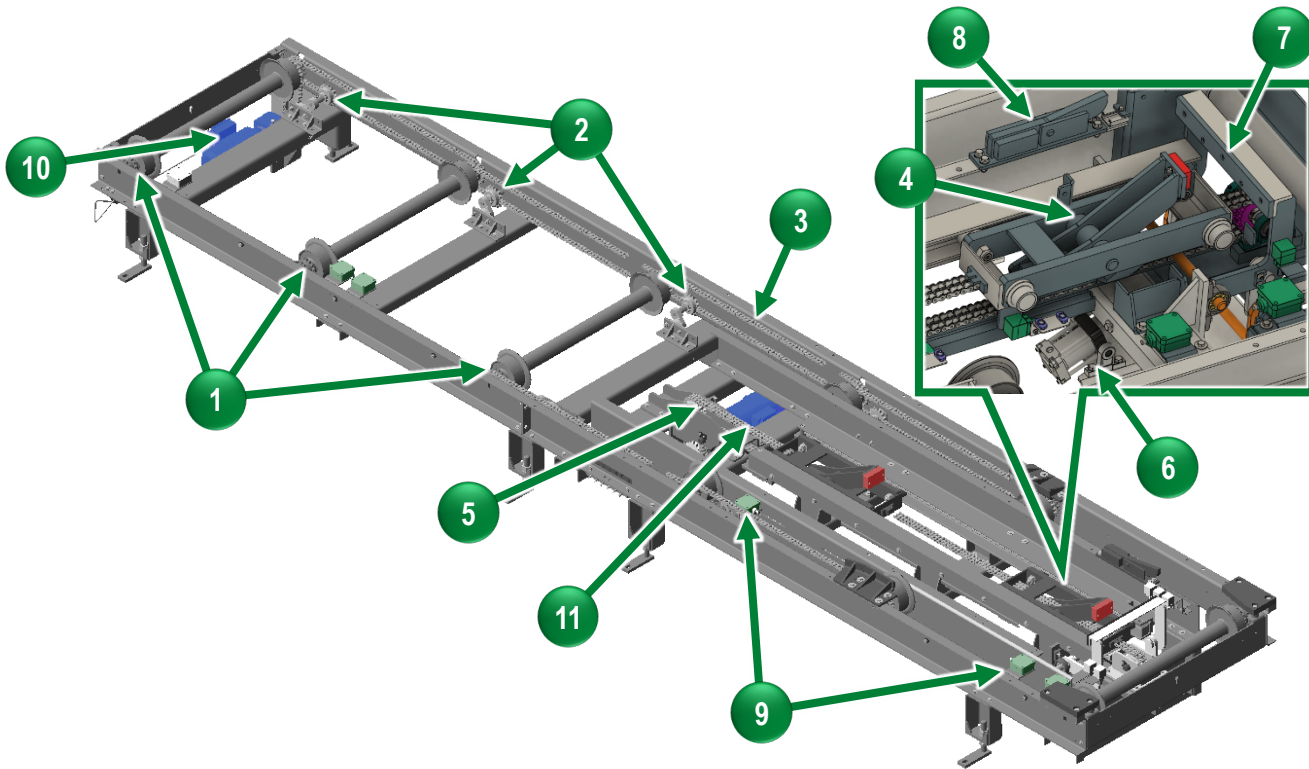
ELPO Pendulum System - Components

The following components were replaced for the Electro-Coating Paint Operation (E-Coat, ELPO) Pendulum System at GM Lansing Grand River during the December 2025 Shutdown and supporting maintenance information, where applicable, is included in this manual:

- *Pendulum Inlet Table*
- *Pendulum Drive Assembly*
- *Pendulum Take-Up*
- *Pendulum Chain & Pins*



Pendulum Inlet Table



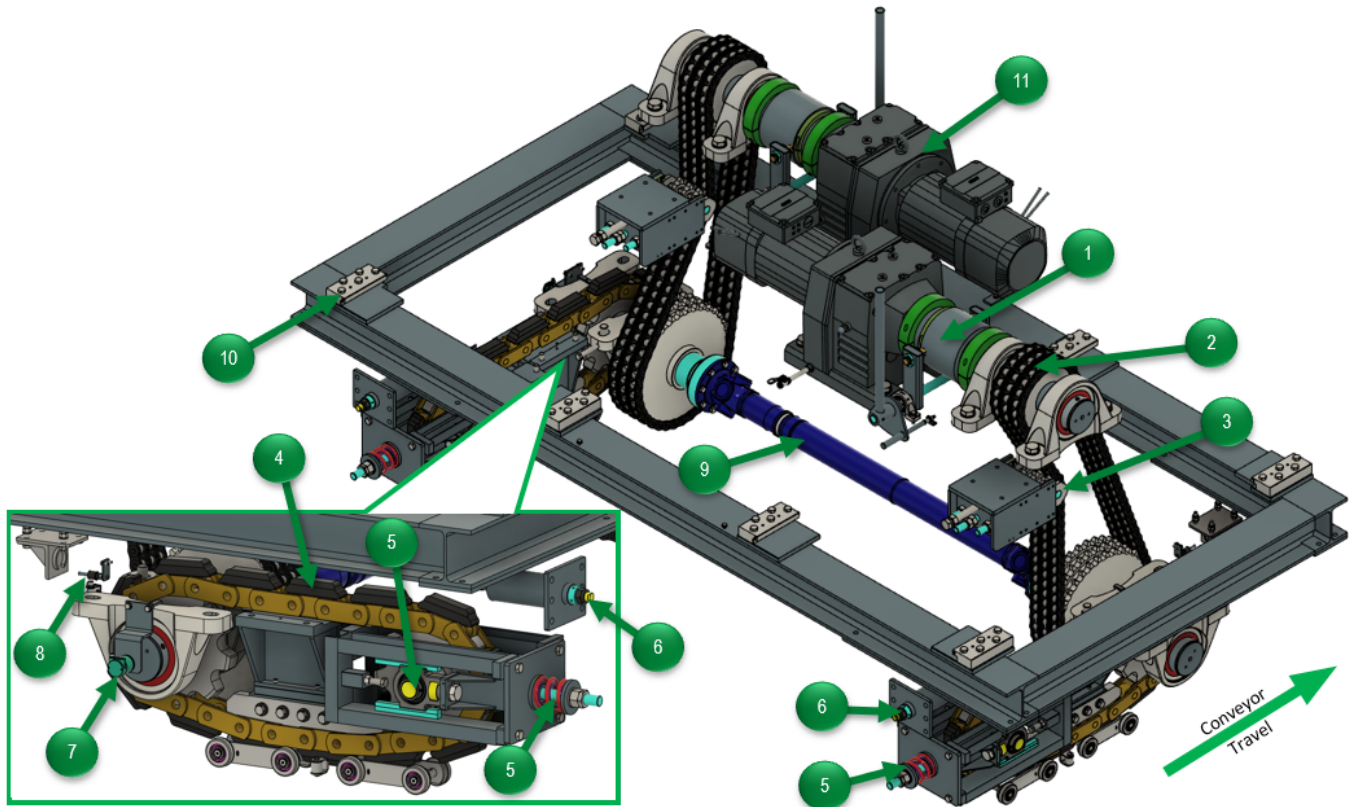
▲ Render shown with Safety Covers removed to show details.

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	8	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 Penduls. 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 Drive Assembly



*Covers and structural portions have been removed to show details.

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 & Optional Standby

4 Caterpillar Chain	8 Torque Overload Sensor
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Pendulum Drive Overview

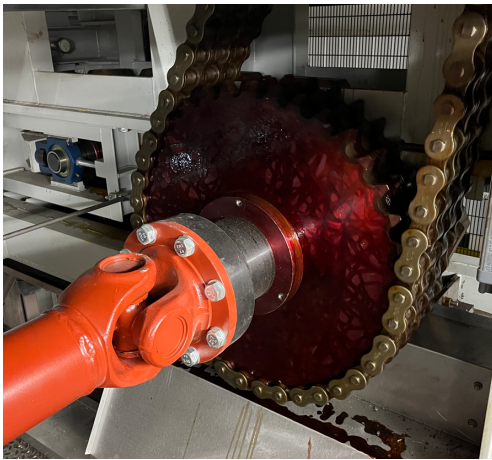
The caterpillar drive assembly of the Pendulum Conveyor pulls the chain for the ELPO (E-Coat) Pendulum System.

Each caterpillar drive assembly has two 15hp SEW gearmotors: main and standby. Only one gearmotor is engaged and uses a coupling to drive the motor sprocket and ultimately drives the conveyor chain. The standby gearmotor is de-coupled from its motor sprocket and does not act upon the conveyor chain. The coupling arm (orange level) will indicate whether a gearmotor is engaged or disengaged.

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 pulls the caterpillar chains on each side.



▲ Main and Standby Drive Assembly for ELPO System at GM Lansing Grand River Paint Shop



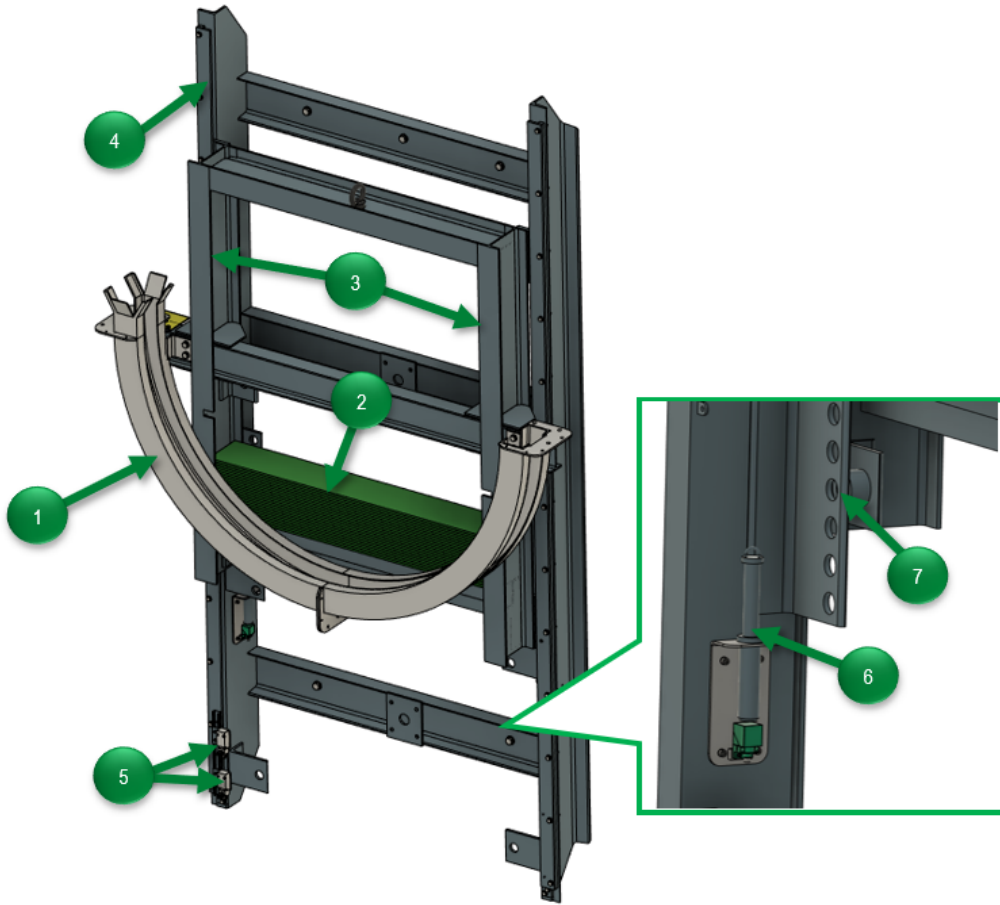
▲ Lower Caterpillar Drive Assembly – Cardan Shaft and Drive Sprocket

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



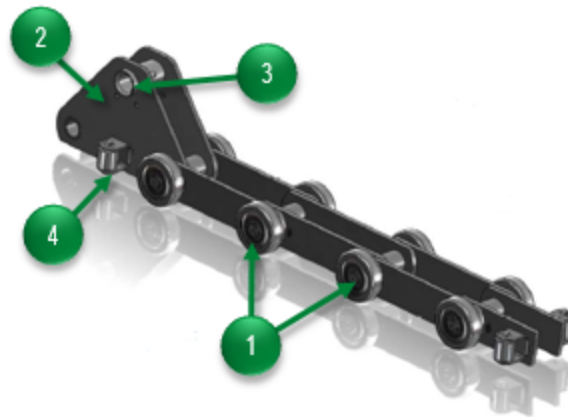
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| 1 Floating Chain Track | 4 Slide Mount Track | 7 Lock-Out Pin Slot |
| 2 Counter Weights | 5 Take-Up Sensors | |
| 3 Slide Mount | 6 Monitored Lock-Out Pin | |

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

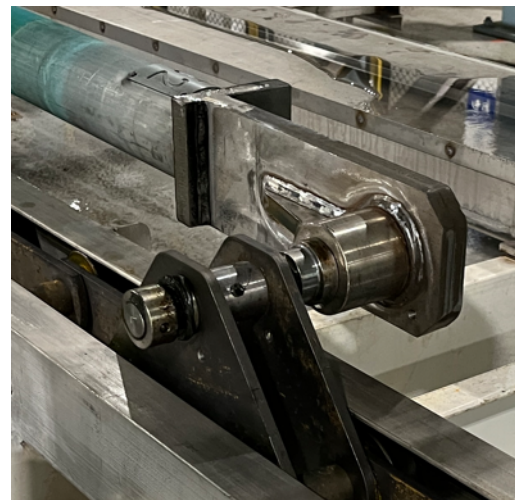


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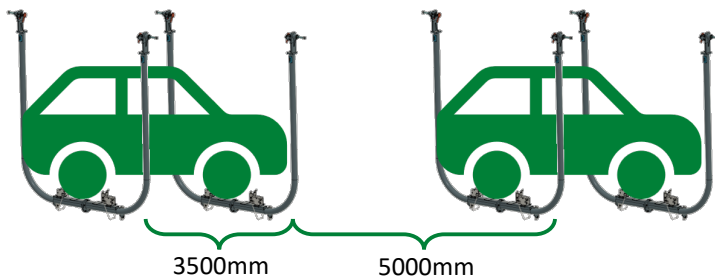
Pendulum Chain Overview

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 5000mm before the next pendul set, totaling 8500mm. Each segment is made up of links of varying types that are all connected with roller pins that ride on the conveyor chain track.

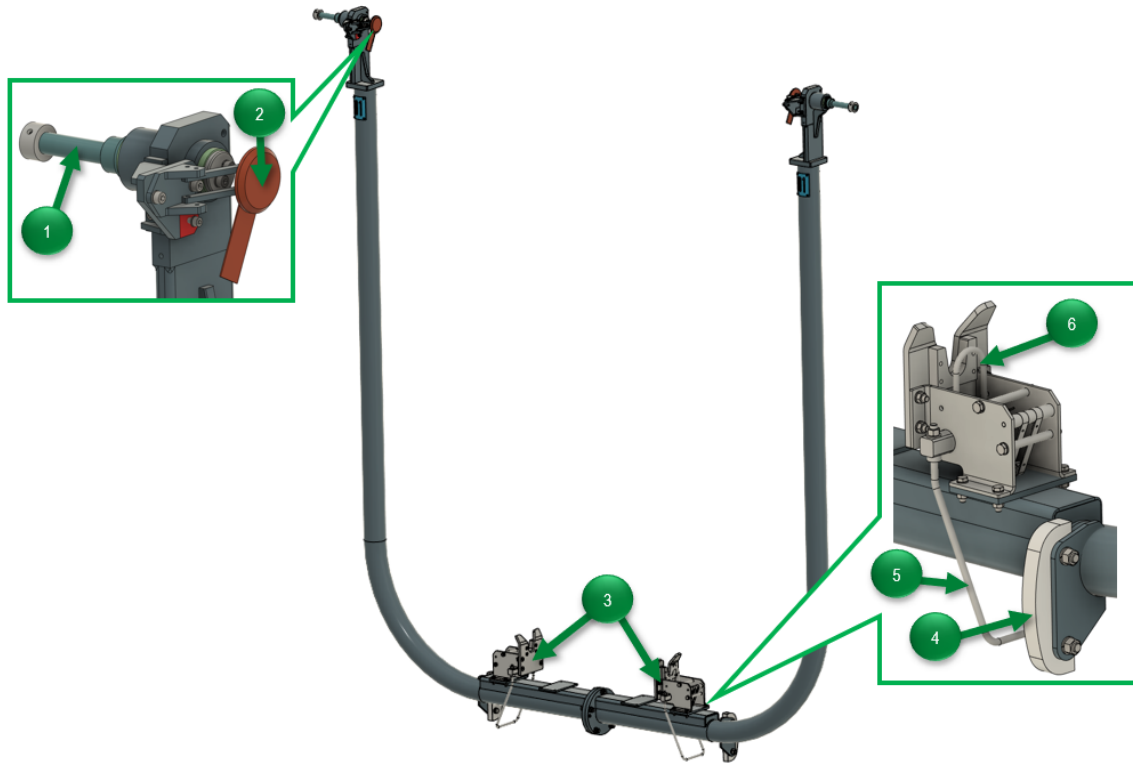
The first link of a segment is triangular when viewed from the side. This link is where one end of a pendul mounts and has side guide rollers to keep the conveyor chain centered in the track. The remaining links are like a standard chain link except that every fourth link has side guide rollers.



Pendulum Chain with a mounted pendul



Penduls



1	Conveyor Chain Attachment (Pins)	3	Skid-Locking Mechanism	5	Latch Arm
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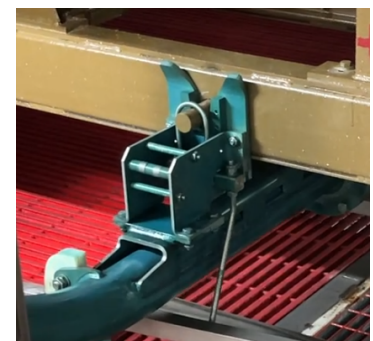
2	Current Collector*	4	Wear Pad	6	Skid Lock
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* Current collectors are only installed in ELPO Pendulum Systems.

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 with a skid