Spiral Conveyor Integration

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1. Spiral Conveyor Controls

As a Spiral Conveyor is generally part of a larger production line, meaning that it has interaction with the machine in front of and behind the Spiral Conveyor, and is relatively easy to control, it is normally designed and manufactured without a control system (unless explicitly specified). Some key features to keep in mind in designing the control system for a Spiral Conveyor are:

¬ Controls must be designed to prevent unintended accumulation and to prevent product back-ups in the Spiral Conveyor.

¬ Controls should be setup in a cascading control method.

¬ The conveyor feeding the Spiral Conveyor should not start before the Spiral Conveyor is running at operational speed.

¬ In case the conveyor behind the Spiral Conveyor is jammed or full the Spiral Conveyor and conveyor feeding the Spiral Conveyor should stop immediately.

¬ The Spiral Conveyor is equipped with several sensors to prevent unwanted situations. Always double check that these sensors have been properly integrated into the controls.

¬ The Spiral Conveyor is standardly delivered without any emergency push buttons, these must be included before commissioning.

2. Conveyor speeds

¬ The downstream and upstream conveyors should be operated at the same speed as the Spiral Conveyor.

¬ The maximum speed of a Spiral Conveyor is 60m/min.

¬ The maximum speed of a Mass Flow Spiral Conveyor is 24m/min.

¬ The minimum speed of a Spiral Conveyor is 10m/min.

¬ The minimum speed of a Mass Flow Spiral is 5m/min.

¬ Speed differences between the Spiral Conveyor and the downstream or upstream conveyors can lead to an overload of the Spiral Conveyor and can lead to excessive wear of the friction inserts and the chain assembly.

3. Variable Frequency Drive

¬ In order to smoothly start and stop a Spiral Conveyor a Variable Frequency Drive (VFD) is required.

¬ The ramp-up and ramp-down time of a Spiral Conveyor needs to be more than 3 seconds.

¬ The brake of the Spiral Conveyor gear motor needs to be enabled after the motor is stopped using the frequency drive.

¬ In an emergency stop the brake needs to be applied immediately.

4. Gap between loads

¬ A gap is required between the products when entering the Spiral Conveyor in order to prevent jamming of products in the Spiral Conveyor.

¬ The minimum gap must be set such that the products do not touch each other in the Spiral Conveyor. As a rule of thumb a minimum gap length of 1/3 of the product length can be used.

¬ The Spiral Conveyor may not be used to create the gap between the products.

5. Transfer sections in and out of the Spiral Conveyor

¬ Products must be positioned in the center of the slats when entering the Spiral Conveyor (unless explicitly mentioned otherwise)

¬ Products must be positioned within the slat width when entering the Spiral Conveyor (unless explicitly mentioned otherwise).

¬ To ensure a smooth transition the infeed conveyor should be positioned slightly higher than the Spiral Conveyor (1-3mm)

¬ To ensure a smooth transition the outfeed conveyor should be positioned slightly lower than the Spiral Conveyor (1-3mm)

6. Sensors (standard on all Spiral Conveyors)

All Apollo Spiral Conveyors are delivered with the following sensors:

¬ **Gear motor overload sensor.**

The gear motor is mounted on the drive shaft and is connected to a torque arm. This torque arm is held in place by a coil spring. In case of an overload on the gearmotor the torque arm will rotate since the spring will be compressed at high loads. In order to monitor this a proximity sensor is installed and in case of too large movement the Spiral Conveyor should perform an emergency stop.

• The proximity sensor is installed on the Spiral Conveyor at the gear motor torque arm.

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- A PNP type sensor is standardly delivered.
- The proximity sensor is a normally closed sensor that needs to detect the steel plate during normal operations.
- Once the signal is lost (due to an overload or broken sensor) the system should perform an emergency stop.
- The system can only be restarted after a manual reset of the control system.
- During startup of the Spiral Conveyor the sensor might be activated unintended, therefore it is recommended to neglect the sensor during the ramp-up time of the Spiral Conveyor when starting the Spiral Conveyor.

¬ **Chain tension sensor.**

Regardless of the tensioning system applied on your Spiral Conveyor (coil spring or pneumatics), it is equipped with a proximity sensor to detect low chain tension.

- The proximity sensor is installed on the chain tensioning system.
- A PNP type sensor is standardly delivered.
- The proximity sensor is a normally closed sensor that needs to detect the steel plate during normal operations.
- Once the signal is lost (due to a decreasing chain tension or broken sensor) the system should give the operator a clear warning: "Chain tension too low, please adjust chain tension".
- The chain tension should be adjusted as soon as possible (however, always within 24 hours after receiving the warning). The system can only be restarted after a manual reset of the control system.

¬ **Motor temperature sensor.**

Each gear motor that is installed on our Spiral Conveyors is equipped with a temperature sensor. The system should always stop in case the temperature in the motor is too high and thus activates the sensor.

7. Pneumatic chain tensioning system.

Depending on chain length and load of your Spiral Conveyor the machine will standardly be equipped with a pneumatic chain tensioning system instead of a coil spring chain tensioning system. A pneumatic chain tensioning system requires the following:

¬ 8mm air hose
¬ 6 bar air supply
¬ Average air consumption: 0.005 m3 per hour
¬ Peak air consumption: 0.01 m3 per hour

The pneumatic chain tensioning system is equipped with a pressure regulator.

¬ The pressure for an ascending spiral should be set to 1.5bar.
¬ The pressure for an descending spiral should be set to 2bar.

The pneumatic chain tensioning system is furthermore equipped with a pressure sensor.

¬ The pressure sensor is a normally closed sensor that requires pressure to be activated.
¬ Once the signal is lost (due to lost pressure of broken sensor) the system should perform an emergency stop.
¬ The system can only be restarted after a manual reset of the control system.

8. Optional sensors

Depending on your application and/or production line Apollo VTS can offer you various additional sensors to increase the control features of the Spiral Conveyor.

¬ **Additional proximity switch on chain tensioning system.**

This additional sensor works in the same way as the standard proximity switch of the chain tensioning system. However, this sensor should switch when the chain length has become dangerously low (this could also mean the chain has broken) and should perform an emergency stop of the system. This system can be considered as an additional safety on the Spiral Conveyor.

¬ **Missing slat detection.**

A photocell sensor can be installed on the Spiral Conveyor that will detect any missing slats on the chain.

- The missing slat photocell sensor is installed in the return path of the Spiral Conveyor.
- The sensor is a normally closed sensor (high signal when no slats are broken).
- In case of a broken slat the sensor will detect the mirror and will be activated and the signal will be lost.
- In case of a lost signal (due to activation or a broken sensor) the system should give a warning or perform a normal stop (depending on your preference or the preference of the end-user).

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