



Safety Application on the Tobacco Cutting machine

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Allen-Bradley • Rockwell Software



Background

ginal safety strategy & Risk assessment

New safety strategy

RA solutions for reference

Value / Differentiation

Machine Purpose

 Tobacco Cutting Machine is designed to cut all types of tobacco leaf into long thin strands for rolling cigarette.



Brief Information on Machine Description



Machine Function

- Tobacco Cutting Machine is designed to cut all types of tobacco leaf into long thin strands for rolling cigarette.
- Each machine contains:
 - Tobacco leaf feeding servo system and transmission chain

One servo motor is used to control the up and down chains running at synchronized speed in order to feeding

tobacco leaf into the Cutter Head.

- Tobacco leaf cutting servo system and transmission belt

One servo motor drives the cutting drum rotating at high speed through a timing belt in an enclosed Cutter

Head.

- Sharpener

Include a sharpening wheel drive motor and a Forward and Reverse motion motor.

After a lot of use, the cutting blades will be worn and have to sharpening them with a enclosed sharpener or

replace a new one by operator at the cutting drum stop.

There are 8 blades mounted on a cutting drum in 45 degrees arrangement The Forward and Reverse motion motor drive the sharpener rack moving

in order to sharpening each blade when the cutting drum stopped.

Hazards area identification









Old safety strategy & Risk assessment instance

- Using the E-stop button and safety non contact lock switches
- Emergency situation or change the new cutting blades, press E-stop button or any one of the guard doors is opened, all the servo drives power will be turned off.
- In order to checking the processing of sharpening, the Sharpener Front Cover need to be opened, in this time the cutter drum has stopped and not contains any safeguarding measures when the sharpening rack right/left moving.
- The Sharpener and Cutter Head could be opened at all time by



Risk assessment for Hazard area 2 and 3

New Safety Strategy

Emergency Stop

> - Emergency stop function shall be available and operational at all time, when the E-Stop button is operated, all of the motors

(Cutting Drum motor, Feed Chains motor, Forward and Reverse Motion motor) will be stopped with stop category 1, motor will stop at pre-defined maximum deceleration rate, and then safe-off function will be energized at motor stopped.

The stopping time of the cutting drum should be less than 10s.

- Interlock Gate 1, 2 & 3 (for Hazard area 1, 2 & 3)
 - All of the interlock gates can't be opened at machine running, press the E-stop button and wait for 10s stopping time of the

cutting drum, all servo drives' safe-off function will be activated.

- An external power supply provide power to the solenoid inside TLS-3 GD2 gate switches through the delay output of the

safety relay, and all of the lock mechanism of interlock gates released.

- Restart operation

The safe stop reset does not provide a safety-related restart. Restart must be performed by an external Restart button as

automatic restart could result in a hazardous situation. Manual monitored reset.

Guard door 4, 5 (for hazard area 4, 5)

- All of the guard doors could be opened at normal machine running without energize the safe stop for the purpose of

checking sharpening action or daily maintenance or troubleshooting.

- Enable switch operation (optional)

RA Solution 1 (Safety relay wiring diagram)

• Cat.3 EN954-1, Stop category 1 (MSR238 safety delay output), Low cost



RA Solution 1 (Hardware Architectures)



RA Solution 2 (Safety relay wiring diagram)

• Stop category 1 (MSR57P stop speed monitoring), High cost



Value/ Differentiation

- Safe-off capability integrated into servo drive, not only provide safety for personnel, but also reduce machine shutdown time and enable machine productivity enhancement relatively.
- Reduce the fault probability of electronic components caused by the high inrush current due to frequent cycling of the input power supply.
- Contrast to the traditional safety solution, safe-off function inside drive does not need other accessories installed in order to meet the safety specifications, such as two expensive safety contactors used to open mains input power to drive.

Save cost and mounting space.

- Reduce the risk of person severe injury, use the interlock switch with internal power-on released solenoid prevent the operator from entering hazard areas