



Winder Safety Upgrades, - Steps and Guidelines to begin the process

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Today's Speaker



Tom Wochenske
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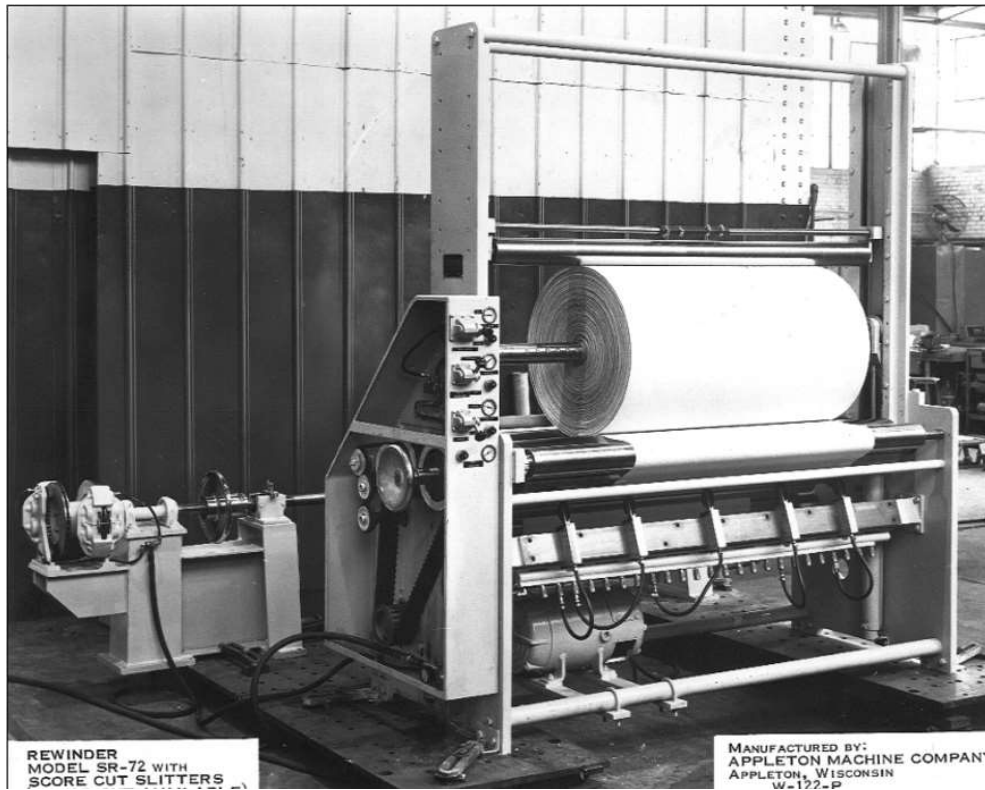
Why the emphasis on winder safety ?

- It's no secret that the winder is one of the highest potential areas of danger in the mill for an operator.
- The winder is a batch process. 5 to 10 times per hour, potential hazards take place.
- Industry attention to safety has increased, and led to the development of corporate safety standards.
- Mills need to be aware that the EN ISO 13849 machinery standards are now in place. It is not just a European standard but an International Standard of which the US & Canada are members.

Increased focus on overall safe guarding of machinery

- Changes in regulations / laws
- Demand from the industry
- Higher speeds and more serious injuries
- Advances in technology
- The high cost of litigation and lawsuits

Winder safety of yesteryear



Winders of the 1960-70s



Winders of the 1980s



New winders of today



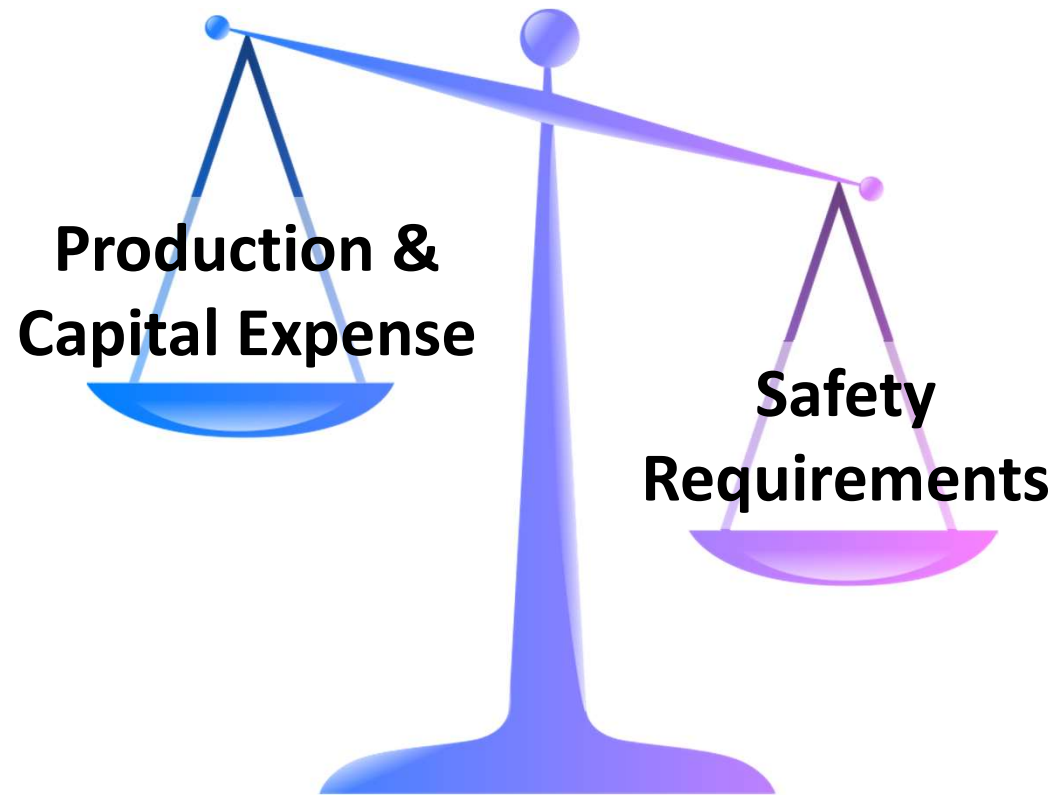
Where do we start?



Key concerns when starting a winder safety rebuild project

- Perform a Risk Assessment
 - Identify all hazards and their severity
- What level of safety should the rebuild scope target, i.e. "How safe is safe enough?" (CAT / PL levels)
 - Some companies have established corporate guidelines that each winder should follow to determine basic proper scope.
- Will the safety upgrade reduce overall line throughput?
- Should automated winder functions be integrated into the scope?

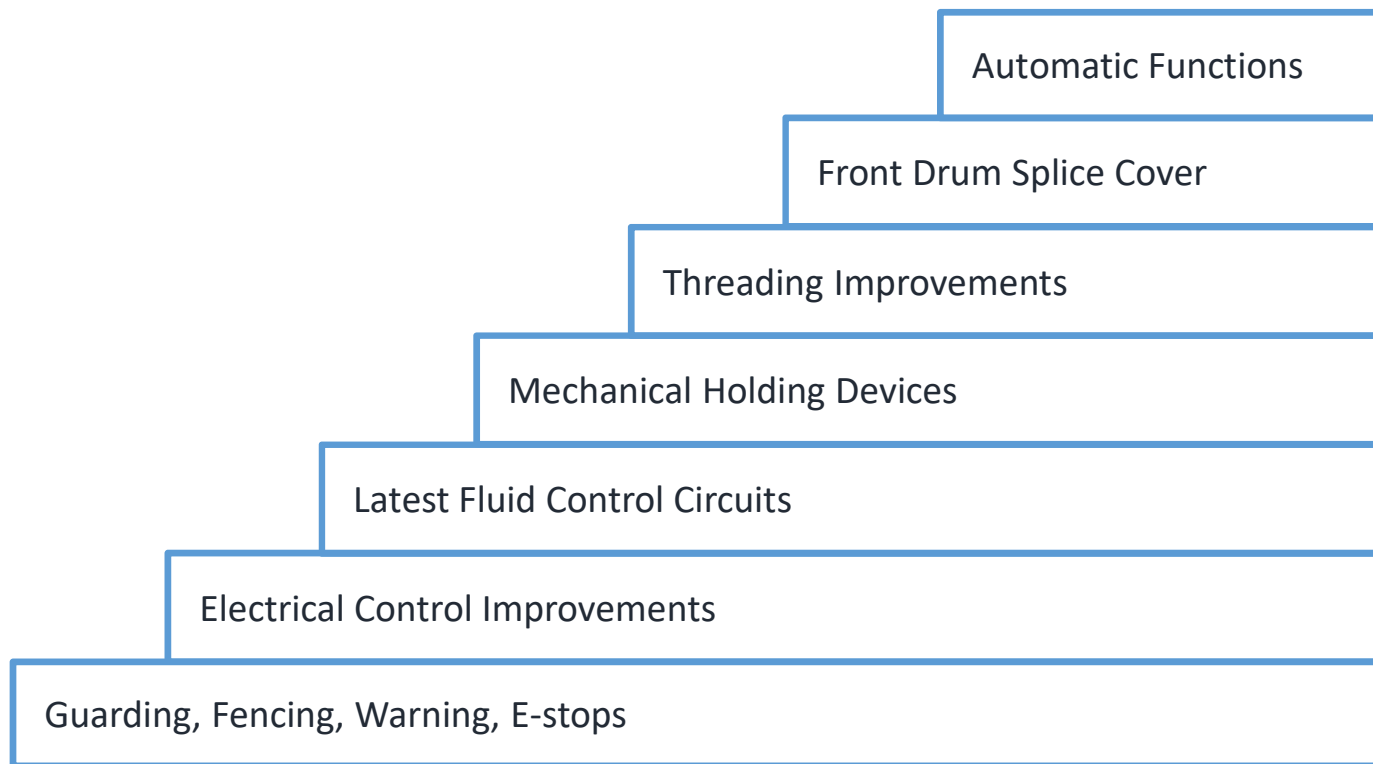
Balancing safety, production and capital expense



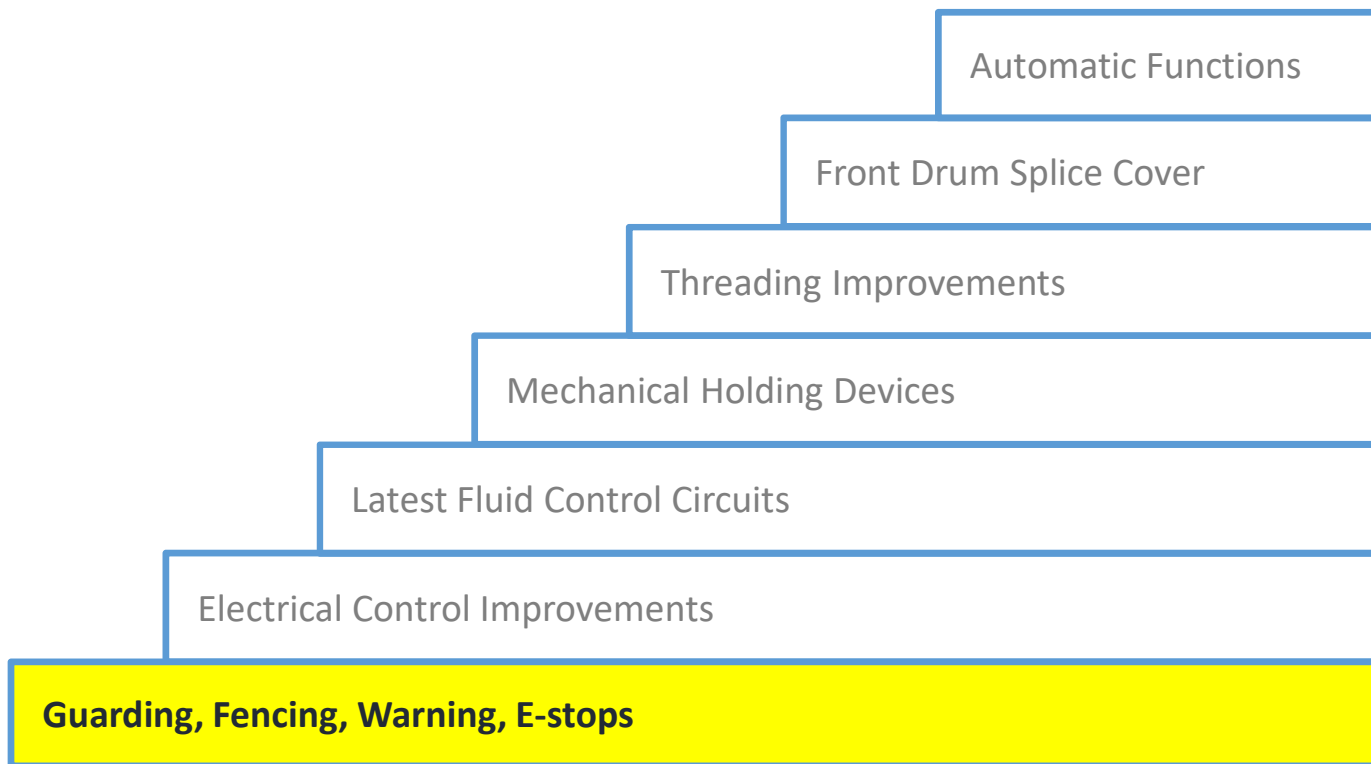
Understanding the new safety guidelines

- The EN13849 standard is a “Controls Circuit / System Standard”.
- It replaces the former EN954 standard.
- The EN Standards have three basic classes:
 - **A:** Basic general guidelines
 - **B:** The 13849 Specification is a process of evaluation and guidance on risk.
 - **C:** Equipment specific- winders follow spec. 1034-3. References specific areas of equipment.
 - Fence
 - Gate
 - Guards
 - etc.

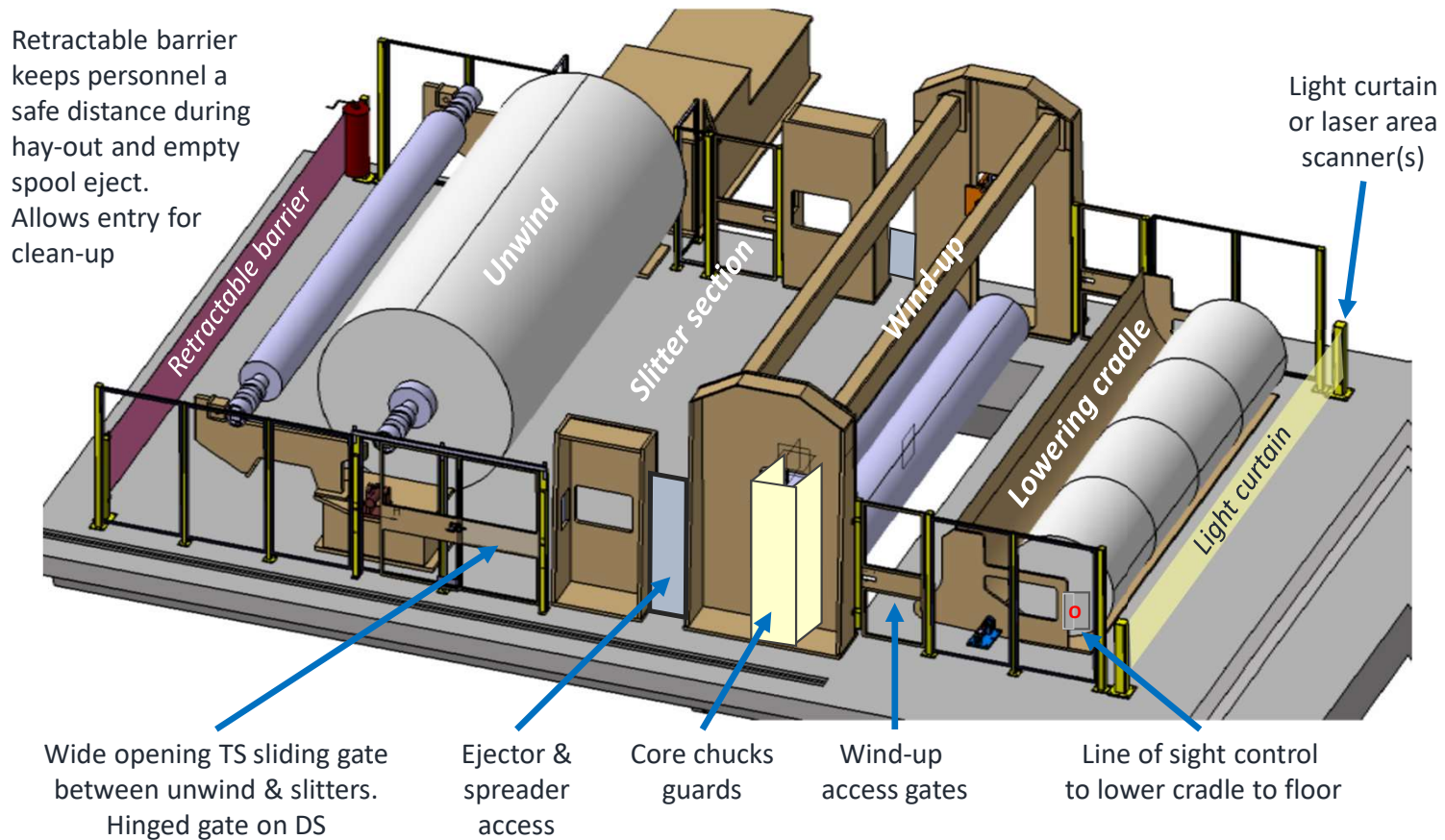
Winder safety improvement steps



Winder safety improvement steps

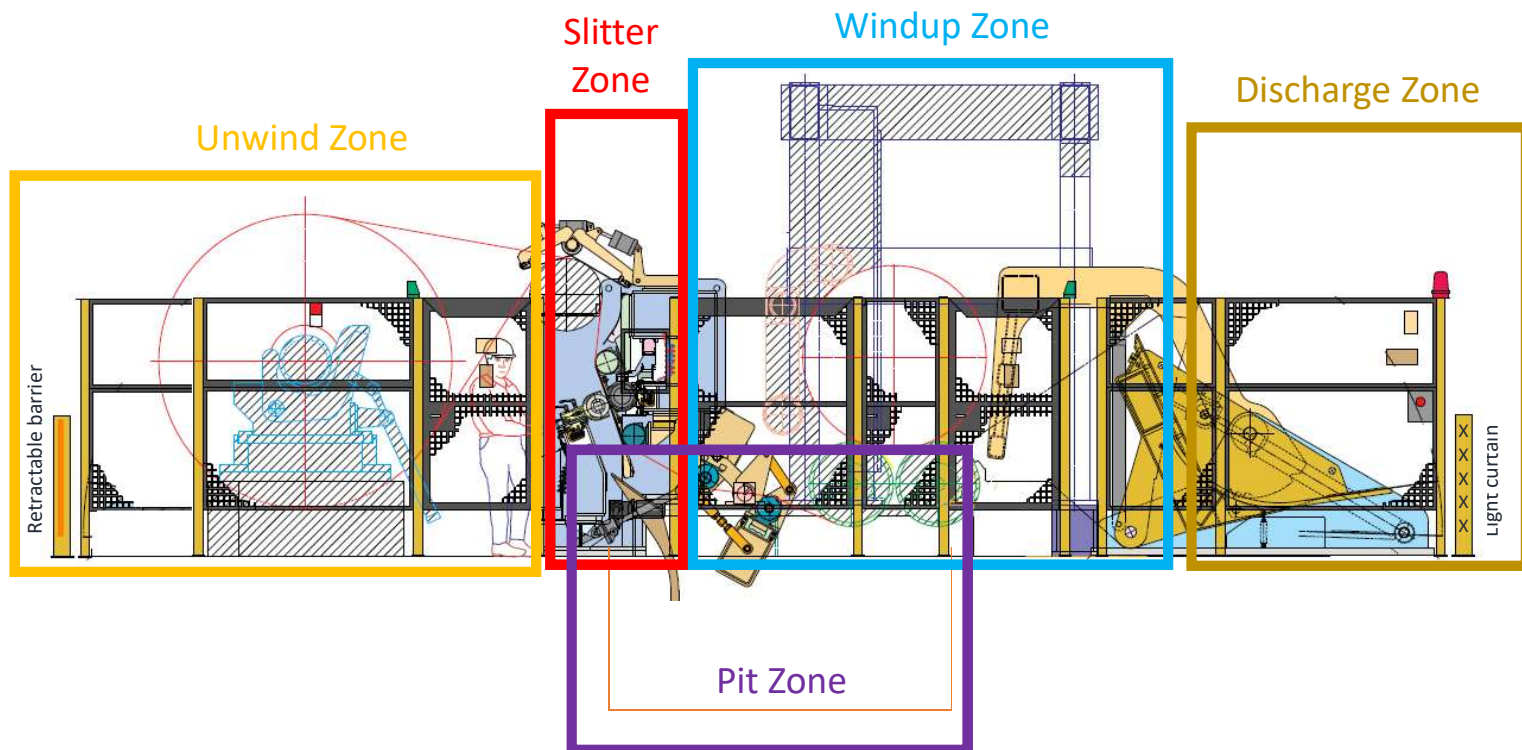


Perimeter personnel access control



Creation of safety zones

- Allows operation in one zone when another zone is infringed
- Improves uptime / capacity

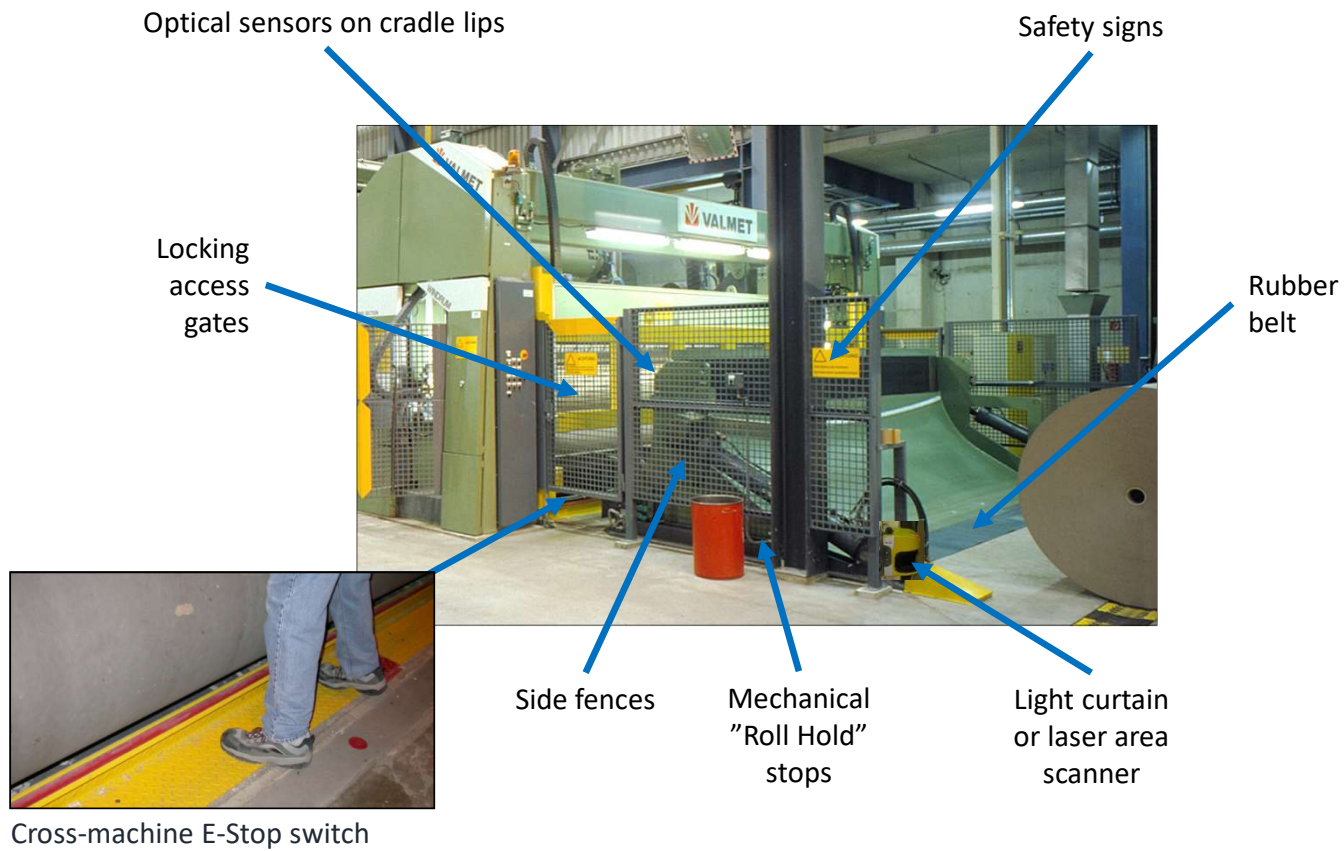


Retractable fence

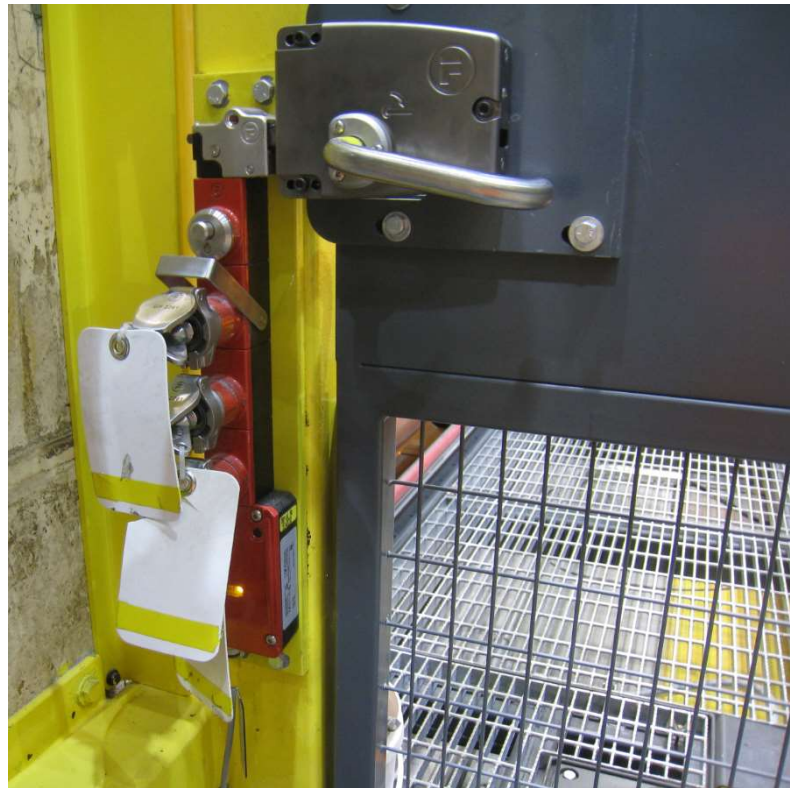
- Retractable fence is a safety device keeping operators away from the danger zone when the curtain is up
- At the unwind, when the safety curtain is unlatched, it isn't possible to kick out empty spools or run above 500 fpm
- When possible, crane movement is not allowed if the unwind safety zone is infringed



Roll discharge safety equipment



Fortress locking gate switch with three trap keys



Request to enter zone / reset zone access pushbuttons



Safety placards describe the danger / potential hazard type



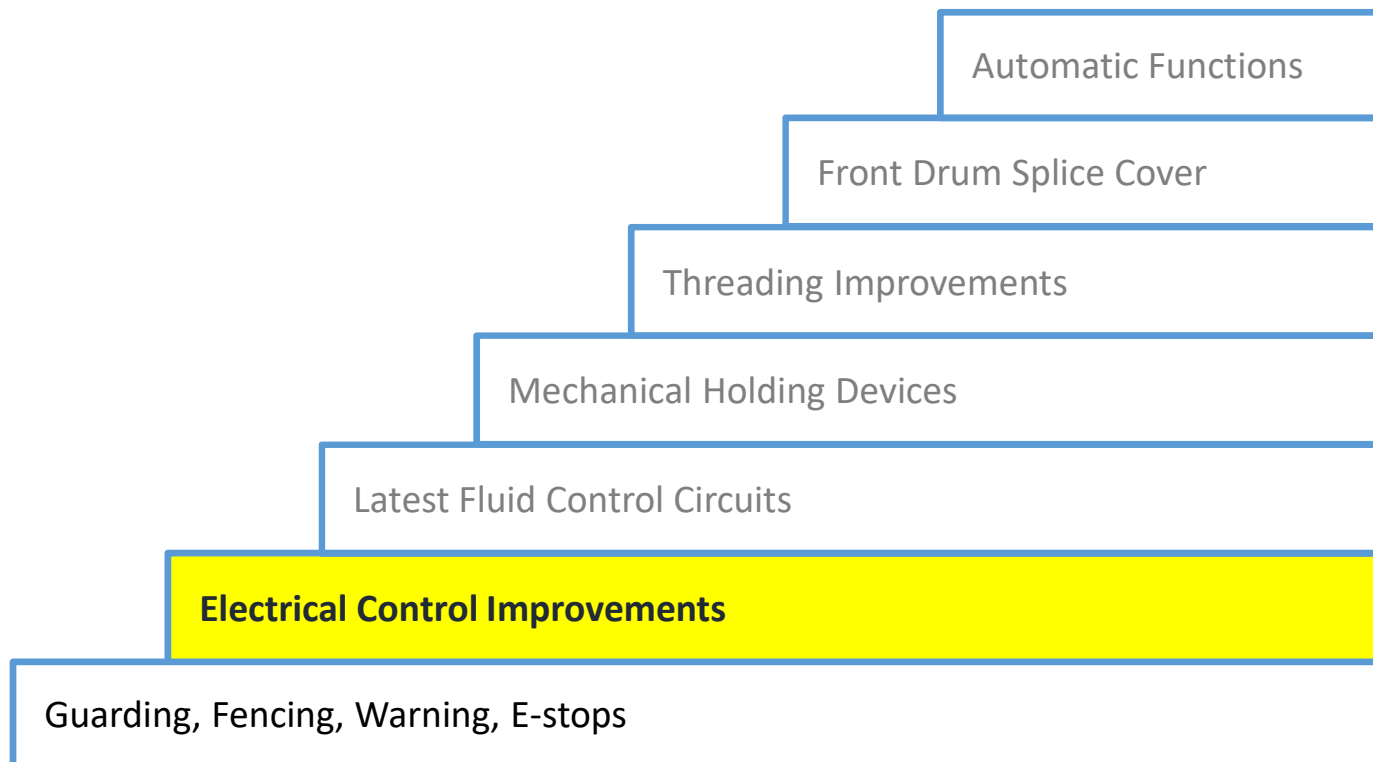
Area between cradle and front drum requires operator protection and control



Area scanner in cradle discharge zone



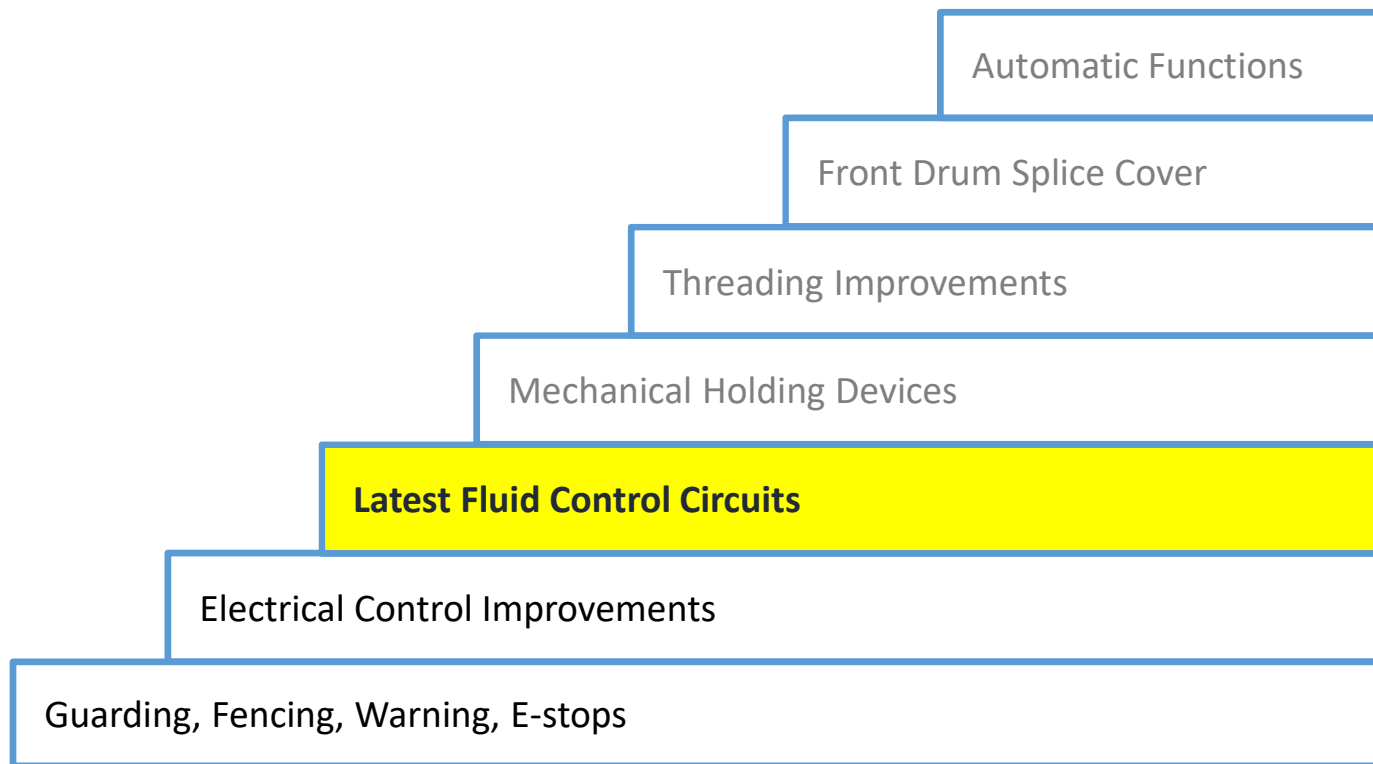
Winder safety improvement steps



Typical second safety step

- - Electrical control improvements
 - Safety PLC
 - Safety I/O monitoring safety devices
 - Remove power from existing fluids and electrical circuits
 - Normally accompanies safety fencing, gates and zones

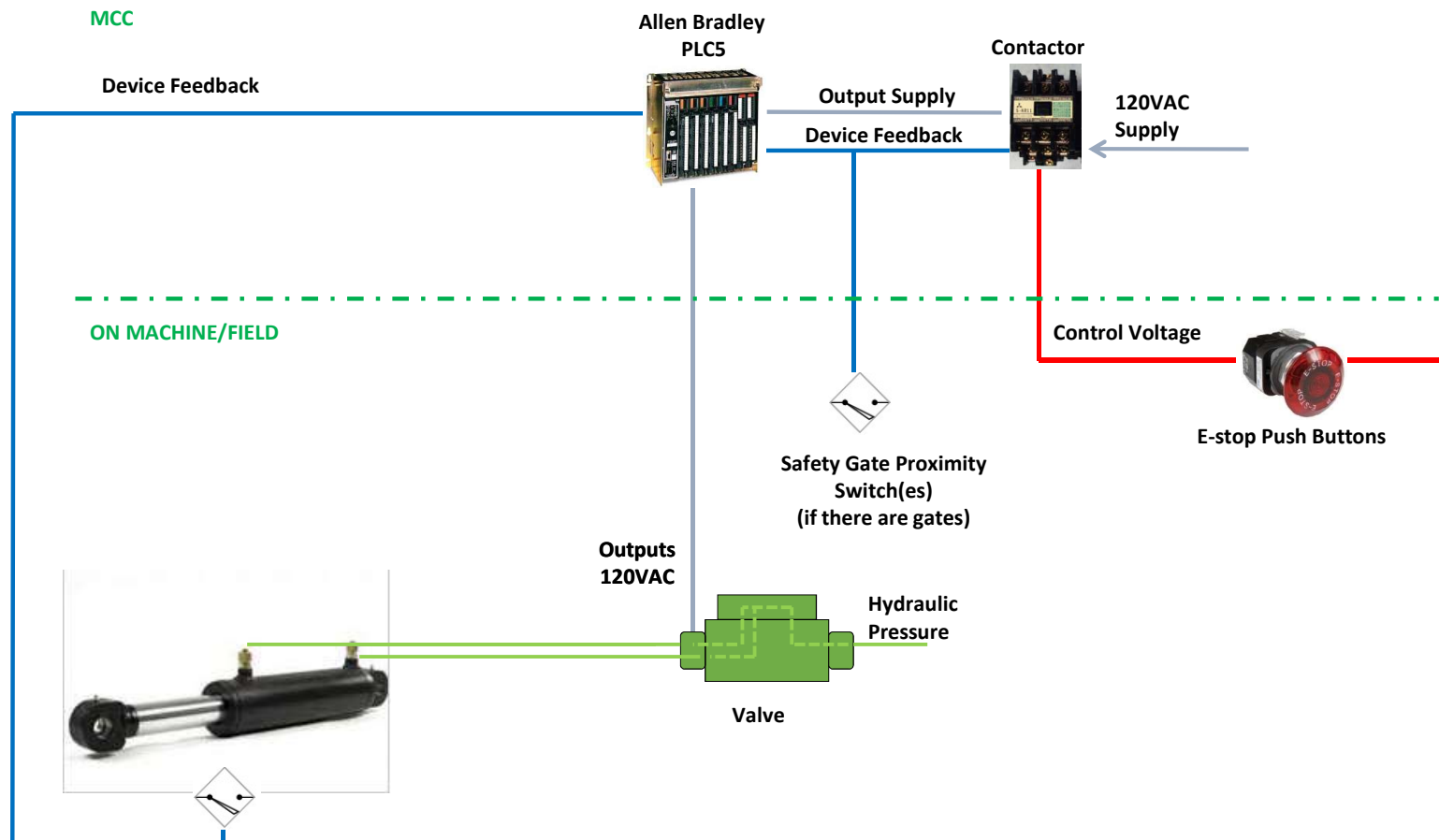
Winder safety improvement steps



Improving fluids controls safety

- - Latest fluids controls
 - Upgrade hydraulic control circuits to latest ISO 13849 level, PLd
 - Circuit feedback devices

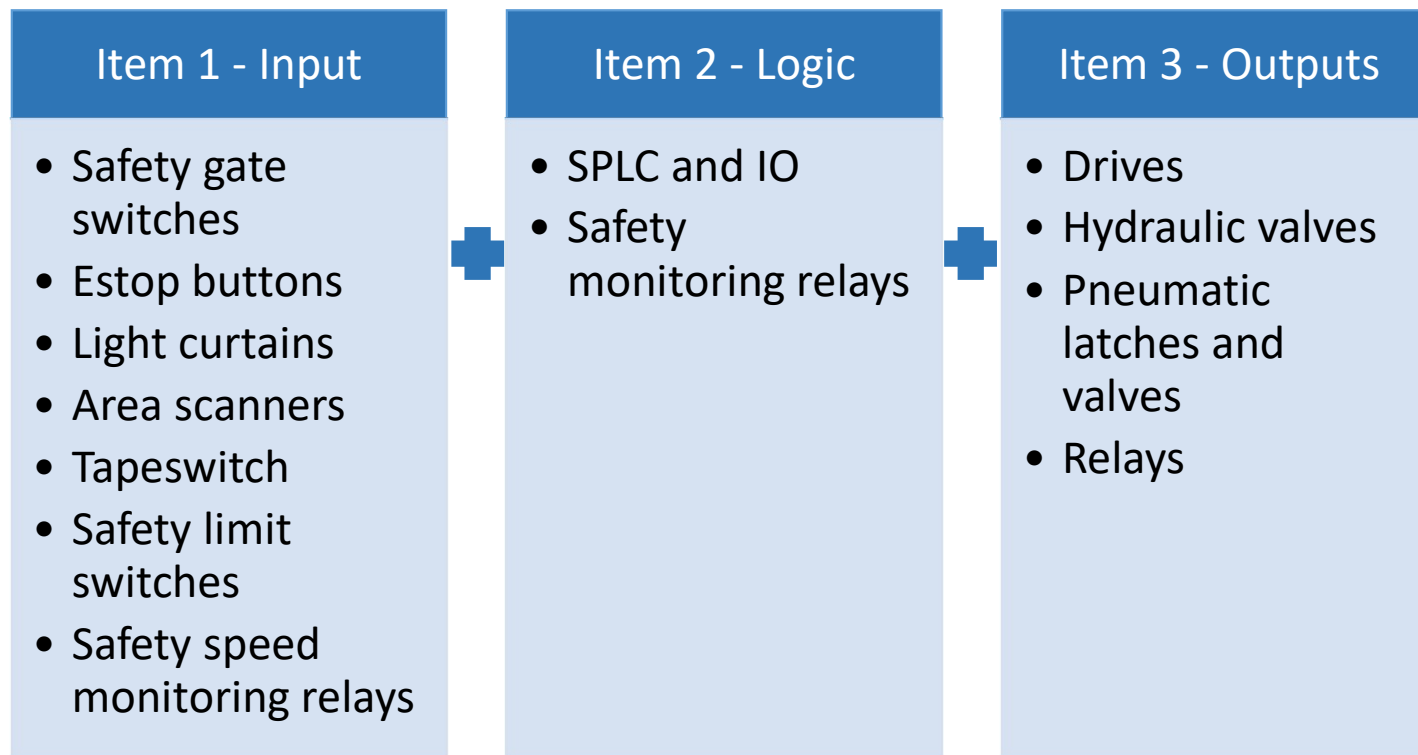
Early PLC design (no safety related components <1990)



Safety rating of a system

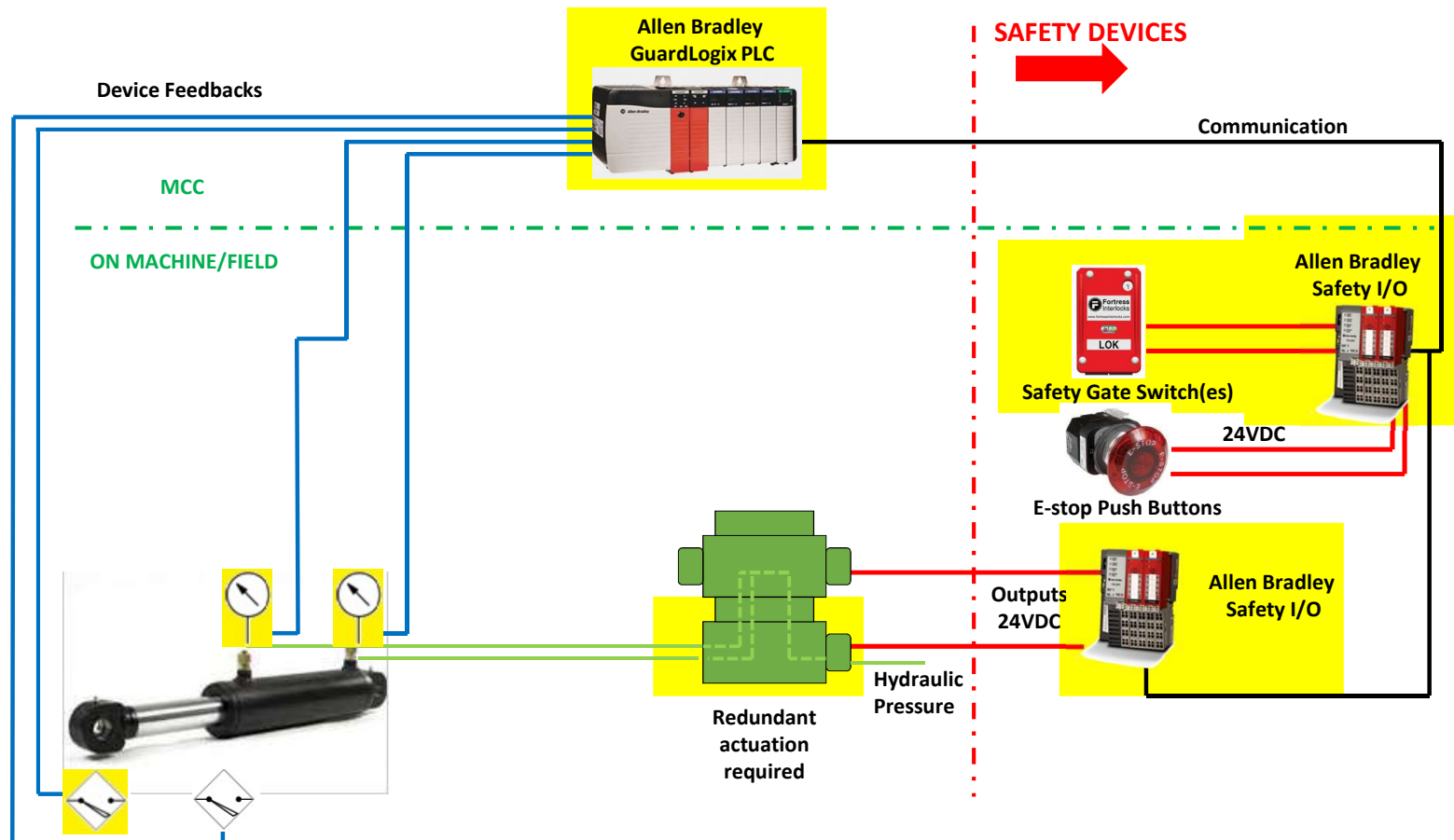
- **CAT1** – Basic system with no redundant components
- **PL_c** – Utilizing components that you can prove will achieve no combined failure **MTTF_d ≥ 30 years**
(Mean Time Between Dangerous Failure)
- **CAT3** - with Redundant components and Diagnostic Coverage. (Ability to detect dangerous faults)
Need > 60% of faults detected
- **PL_d** – Basically verifying that the components of a CAT3 system (Redundant components and Diagnostic coverage) meet the rating of **MTTF_d ≥ 30 years** (Mean Time Between Dangerous Failure)

Three elements of ISO 13849 circuit



ISO 13849 Safety Rated Control

(Includes control system, electrical & fluid actuation and feedback)
PLd component reliability, and CAT 3 redundancy



Structure according to CAT 1 (EN 13849-1, chapter 6.2.4)



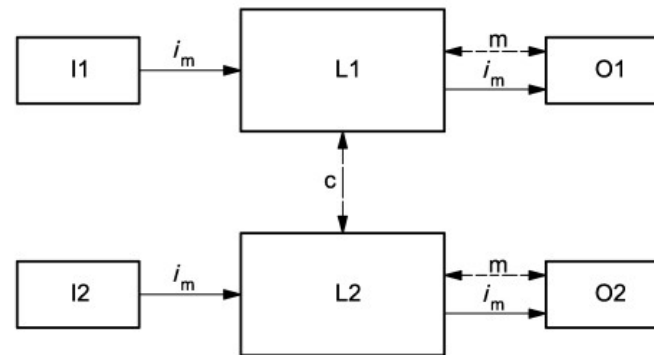
Key

- i_m interconnecting means
- I input device, e.g. sensor
- L logic
- O output device, e.g. main contactor

Figure 9 Designated architecture for category 1

Components of the highest reliability level must be used in the implementation of performance level PL_c ($MTTF_d \geq 30$ years)

Structure according to CAT 3 (EN 13849-1, chapter 6.2.6)



Dashed lines represent reasonably practicable fault detection.

Key

i_m	interconnecting means
c	cross monitoring
I1, I2	input device, e.g. sensor
L1, L2	logic
m	monitoring
O1, O2	output device, e.g. main contactor

Requirements for the implementation of performance level PLd:

- 1) Components of the highest reliability level ($MTTF_d \geq 30$ years) AND diagnostic coverage $\geq 60\%$
- 2) Components of the average reliability level ($10 \text{ years} \leq MTTF_d \leq 30$ years) AND diagnostic coverage $\geq 90\%$

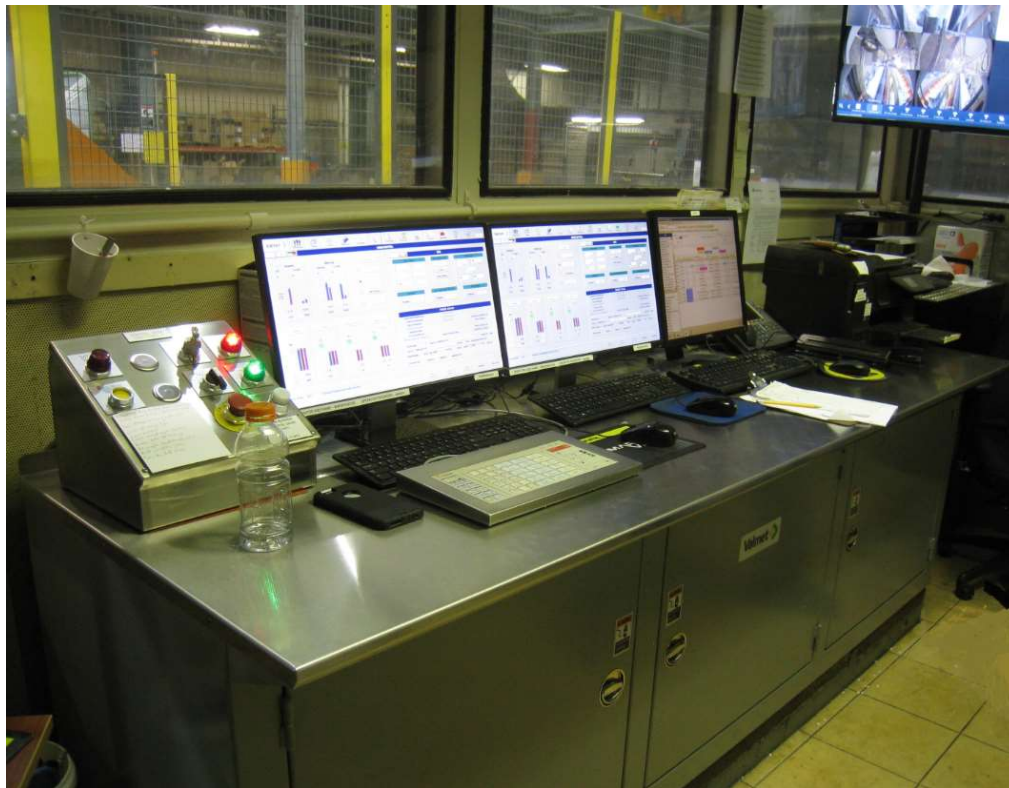
control changes

Winder safety related upgrade

Replace existing console with PC/HMI control desk and remote PanelViews



New operator control panel with safety PLC and new HMI



Windcontrol Recipe Curves WindPosit Auto Winder Run Set Change Core Feed Unwind Help Print F

Winder Help System - Function Select

In this Help System topic screen, the operator can easily see which interlock is stopping the winder function. This screen can also be used to tell an operator if the winder is ready for a function without actually starting it. Clicking on Core Loader, for example, would show all topics for moving the core loader.

Sequences

Safety Gates

There are no items to show in this view
Alarm Summary
E-Stop Buttons
Safety Devices
10/25/2005 9:46:32 AM

Windcontrol Windposit Curves Recipe Set Change Unwind Threading Run Help Print F

Winder Help System

Select Function **DESIRED ACTION**

FUNCTION	STATUS	PLC ADDR	DEVICE
Rider Roll Down On Empty Cores	Off	B10/2701	

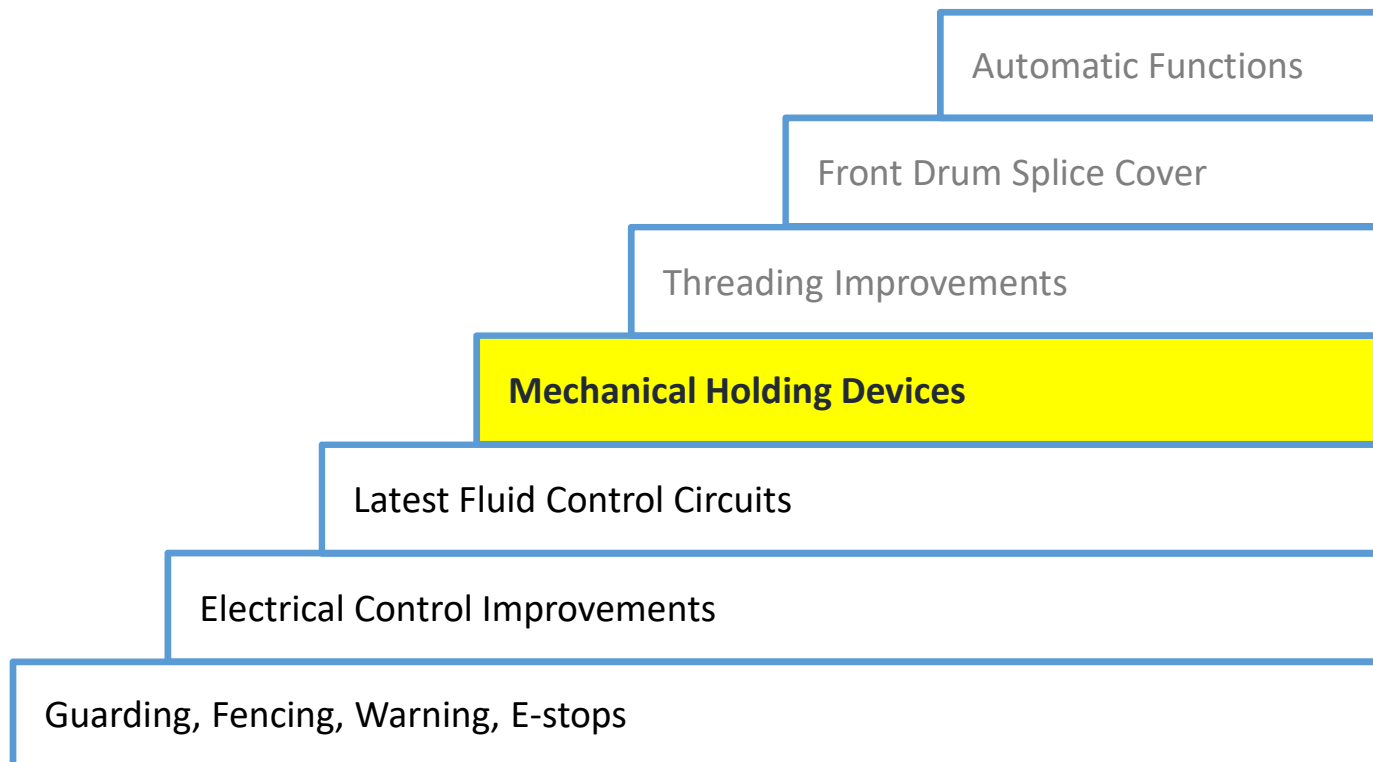
INTERLOCKS

FUNCTION	STATUS	PLC ADDR	DEVICE
Tending Side Core Lock at Down Position	Not Down	I:136/14	26GS10
Drive Side Core Lock at Down Position	Not Down	I:136/12	26GS14
Core Locks Up Solenoid is Off	OK	O:135/04	26GSV02
Core Locks Close Solenoid is On	Close Not On	O:135/10	26SV04B
Threading Quick Stop is Reset	OK	B10/4302	03EC01
Emergency Stop is Reset	OK	N101:12/00	01EK02
Rider Roll Photo-eye Alarm is Reset	OK	N101:14/06	27CS01B
Windup Safety Gates Closed and Reset	OK	N101:15/10	
Web Cutting Device at Home Position	Not At Home	I:144/12	24CS11
Web C			
Roll E			
Automa			
Hydraulic Oil Pressure is OK	OK	N101:13/03	05PS11
Rider Roll Proportional Valve Has Not Faulted	OK	N101:14/09	27GSV03
Safety Lock Open Tend Side (Opens when attempting to lower rider roll)	Not Open	I:140/07	27GS13
Safety Lock Open Drive Side (Opens when attempting to lower rider roll)	Not Open	I:140/05	27GS14

The help system is a tool to diagnose why a machine function does not work by displaying a color coded status of all interlocks for that function.

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Winder safety improvement steps



Mechanical holding devices

- Cradle wait position
- Nip guard up position
- Rider roll full travel
- Core locks full travel
- Ejector at home position

Sliding pin hold stops

- Pneumatic actuated sliding pin type roll hold stops. Sides of cradle are fenced. Discharge is interfaced to light curtain or laser area scanner.



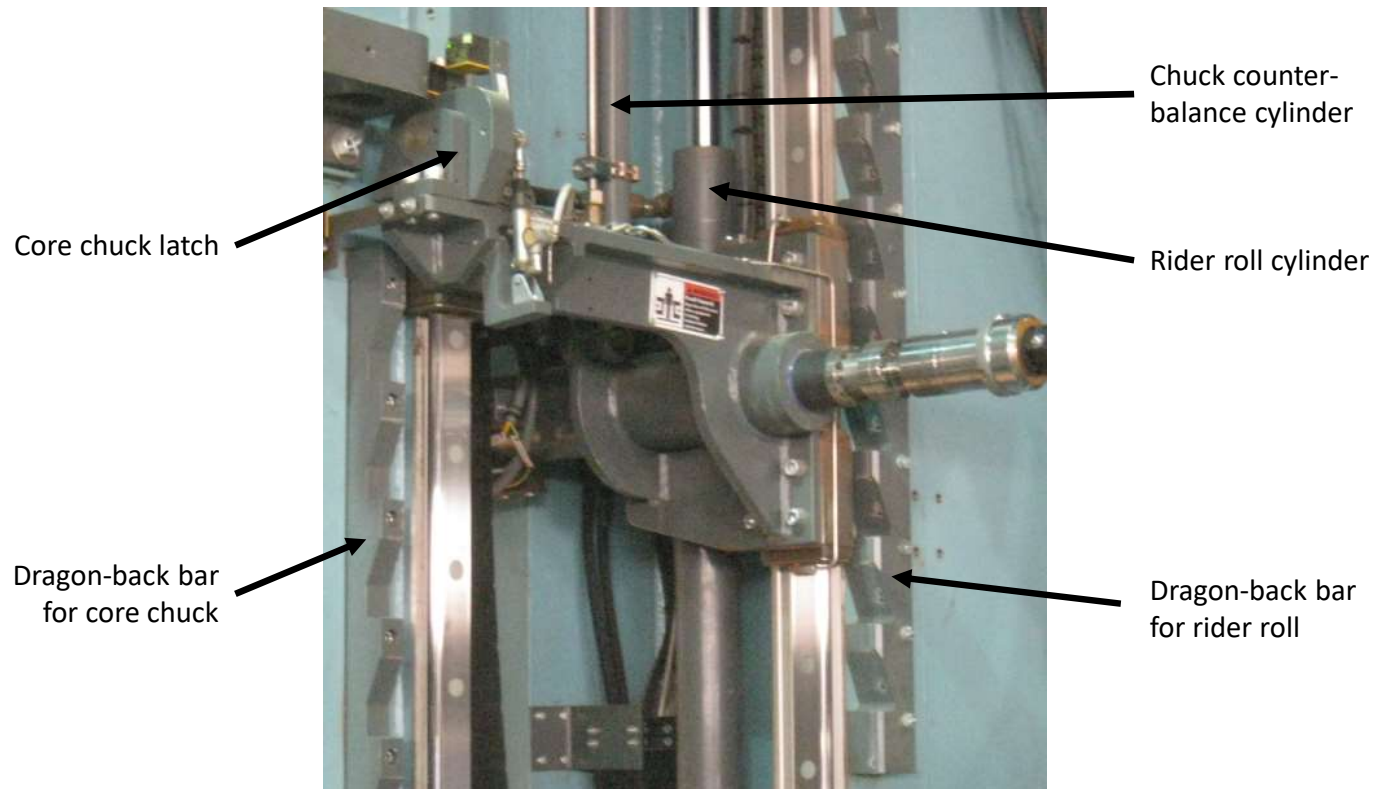
Intermediate stops don't contact cradle. Act as safety stop if cylinder fails / pressure loss



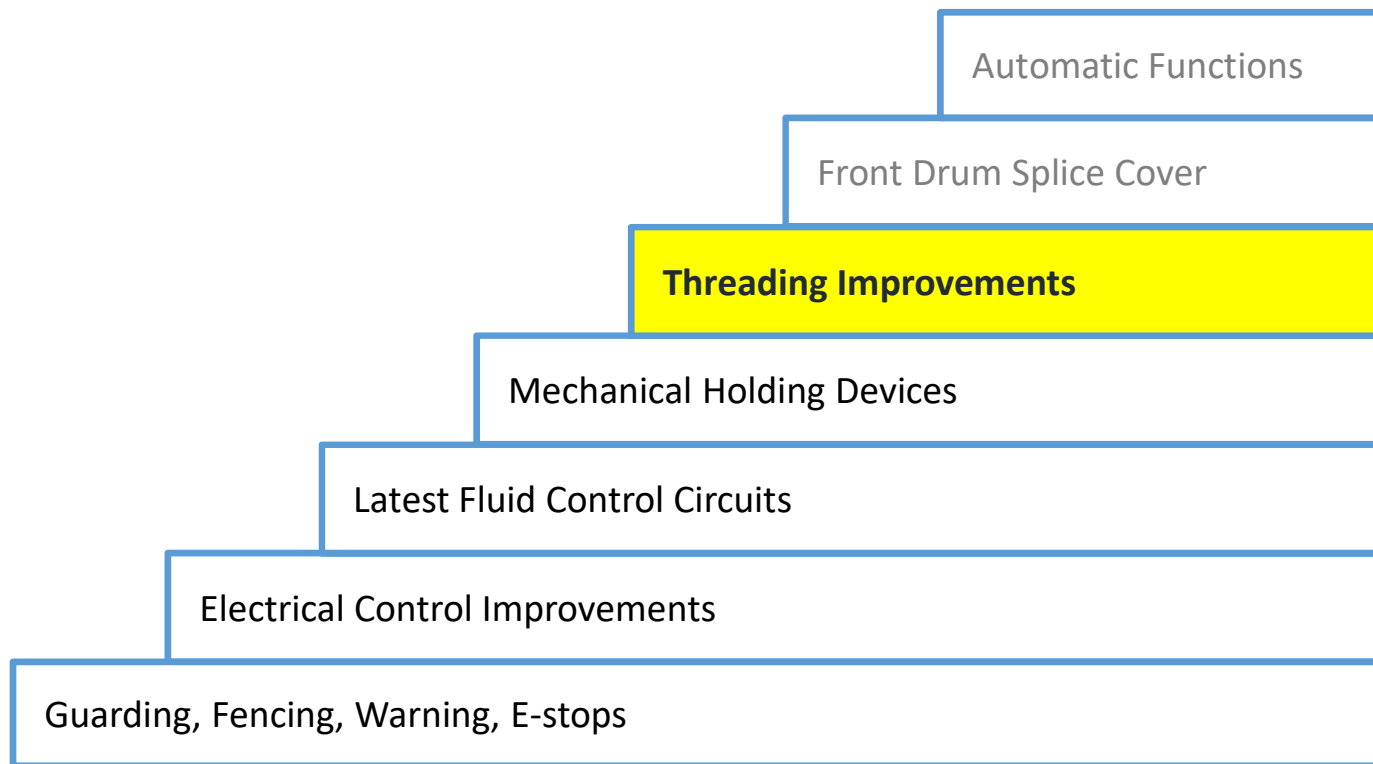
Core chuck safety latch on rebuild of Jagenberg winder



Core chucks and rider roll assemblies have full stroke dragon-back safety latches



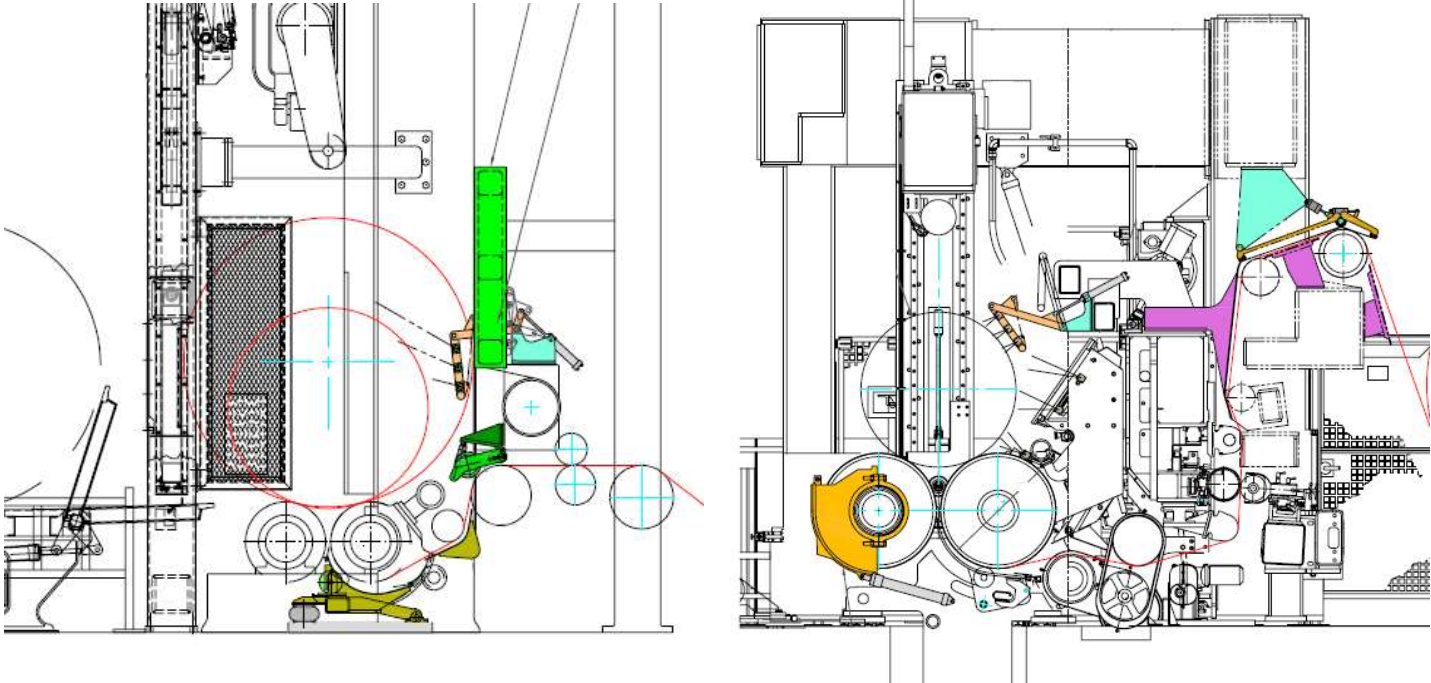
Winder safety improvement steps



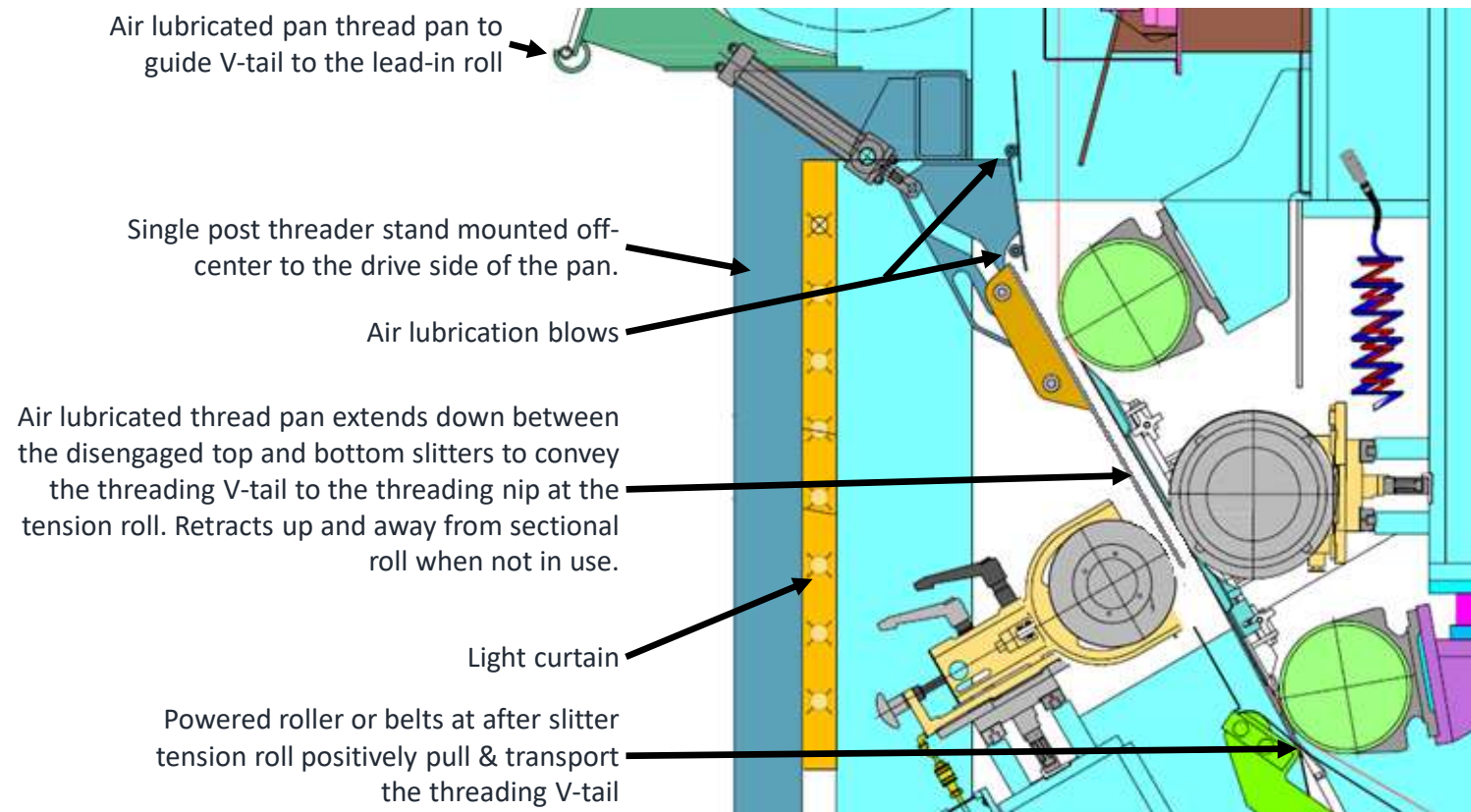
Threading improvements

- Slitters to rear drum threaders
- Splicing air assist jets
- Rear drum web holders
- No cores during threading
- Hold to run interlocking while splicing
- Stop front drum rotating while threading

Threading / Splicing improvements

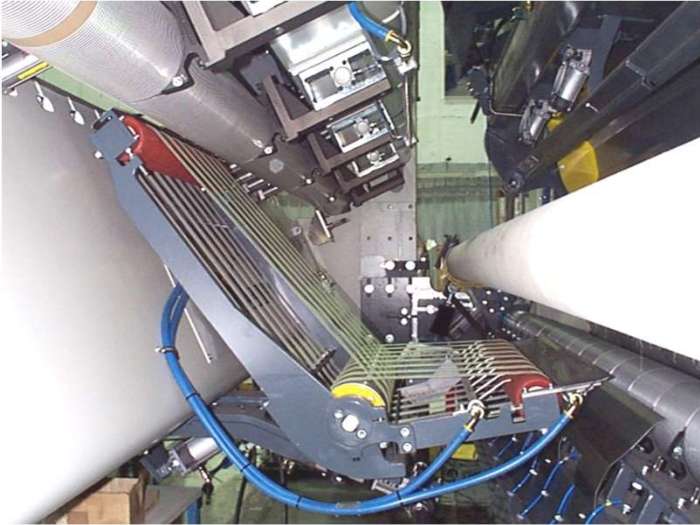


Hands-free automatic threading at slitters

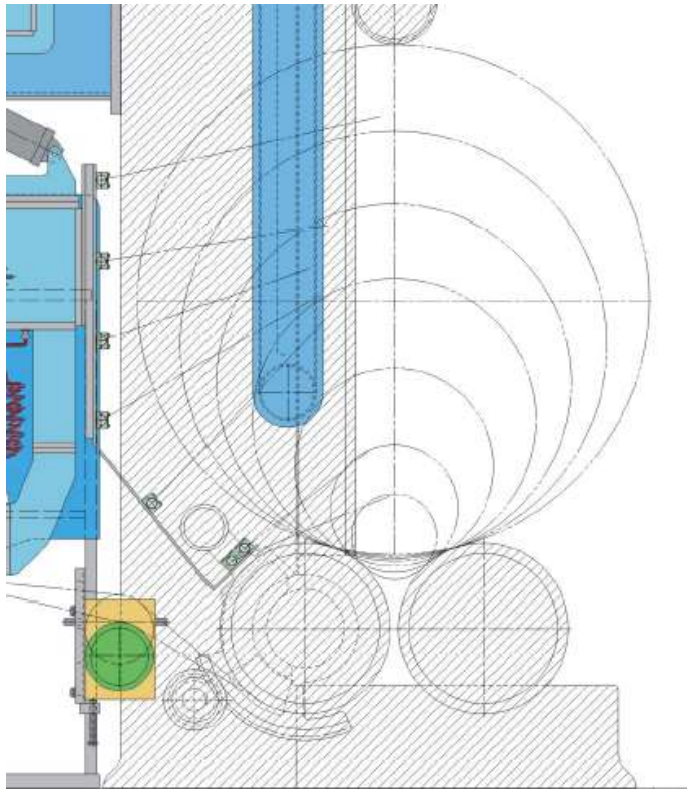


Operator only feeds the threading v-tail to the air lubricated thread pan at the lead-in roll.

After slitter threading with powered belt threader after slitters

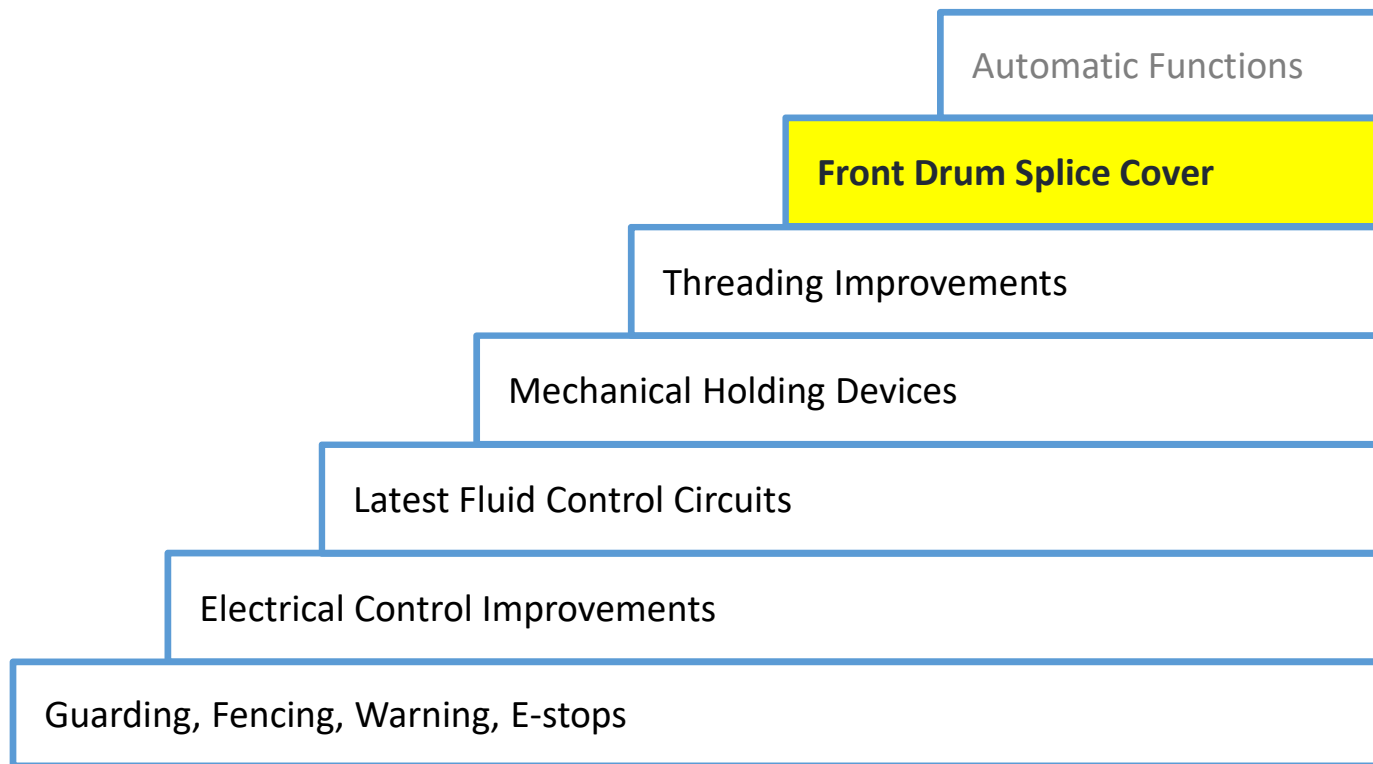


Splicing air blow nozzles



- Guides the threading tail around a partially wound roll after a web break.
- Eliminates the need to crawl onto the winder to manually convey the tail.
- There are separate lower and upper control valves depending on the partial roll diameter.
- Pipes are approximately 36" long.

Winder safety improvement steps

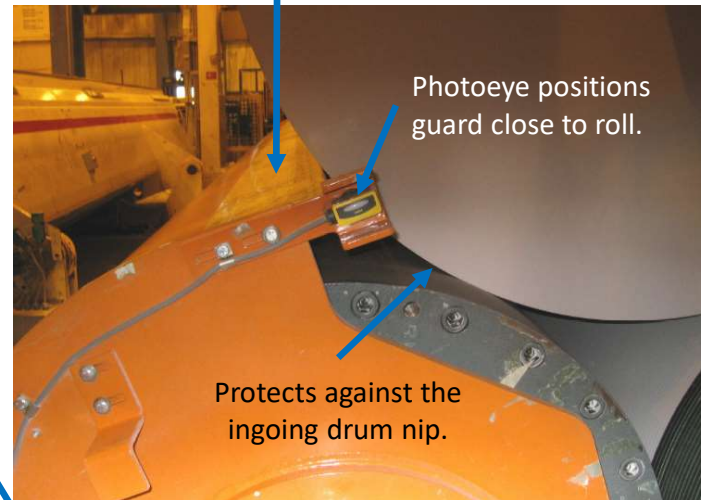


Splicing nip cover in splice position



E-stop bump switch

Taped surface gives a different feel if touching close to the edge.

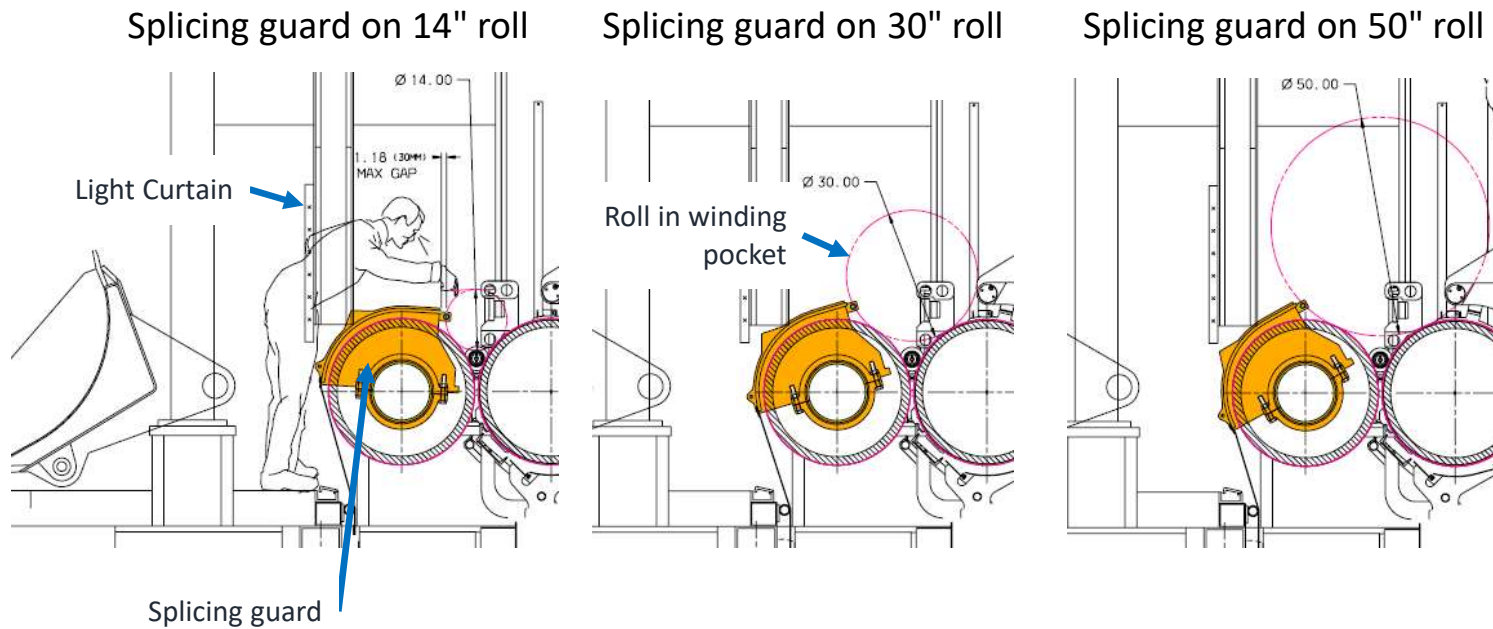


Photoeye positions guard close to roll.

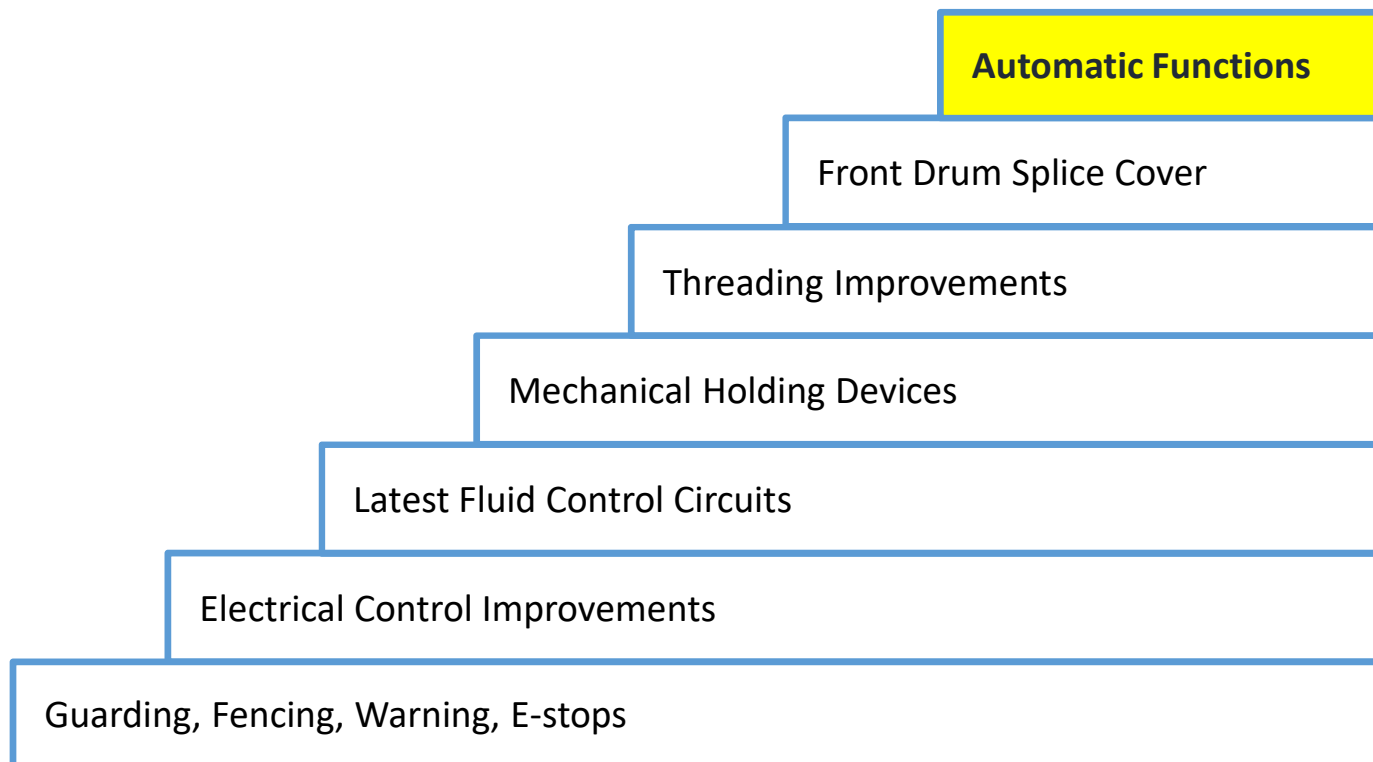
Protects against the ingoing drum nip.

Light curtain prevents positioning if personnel in splicing guard area.

Splicing guard automatically positions to varying roll diameters



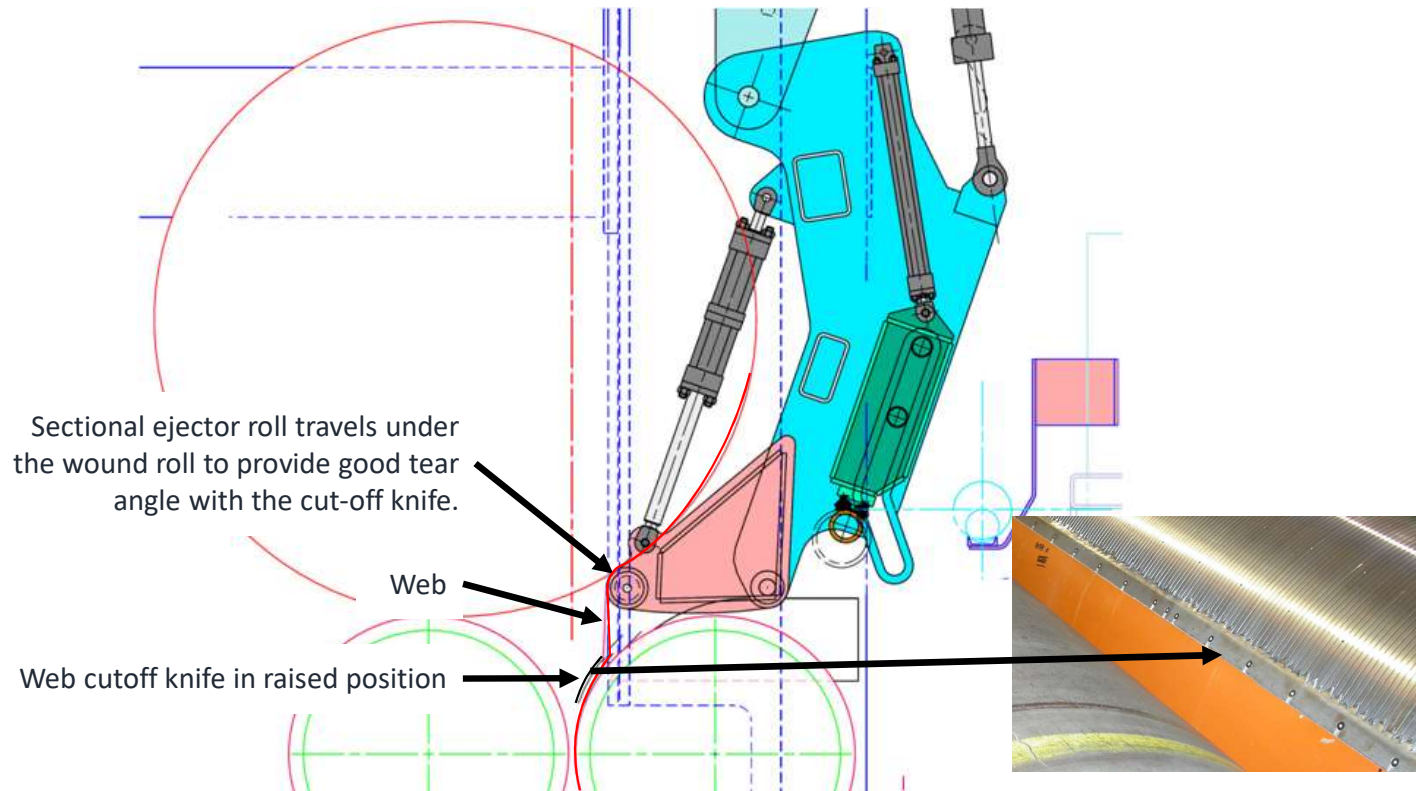
Winder safety improvement steps



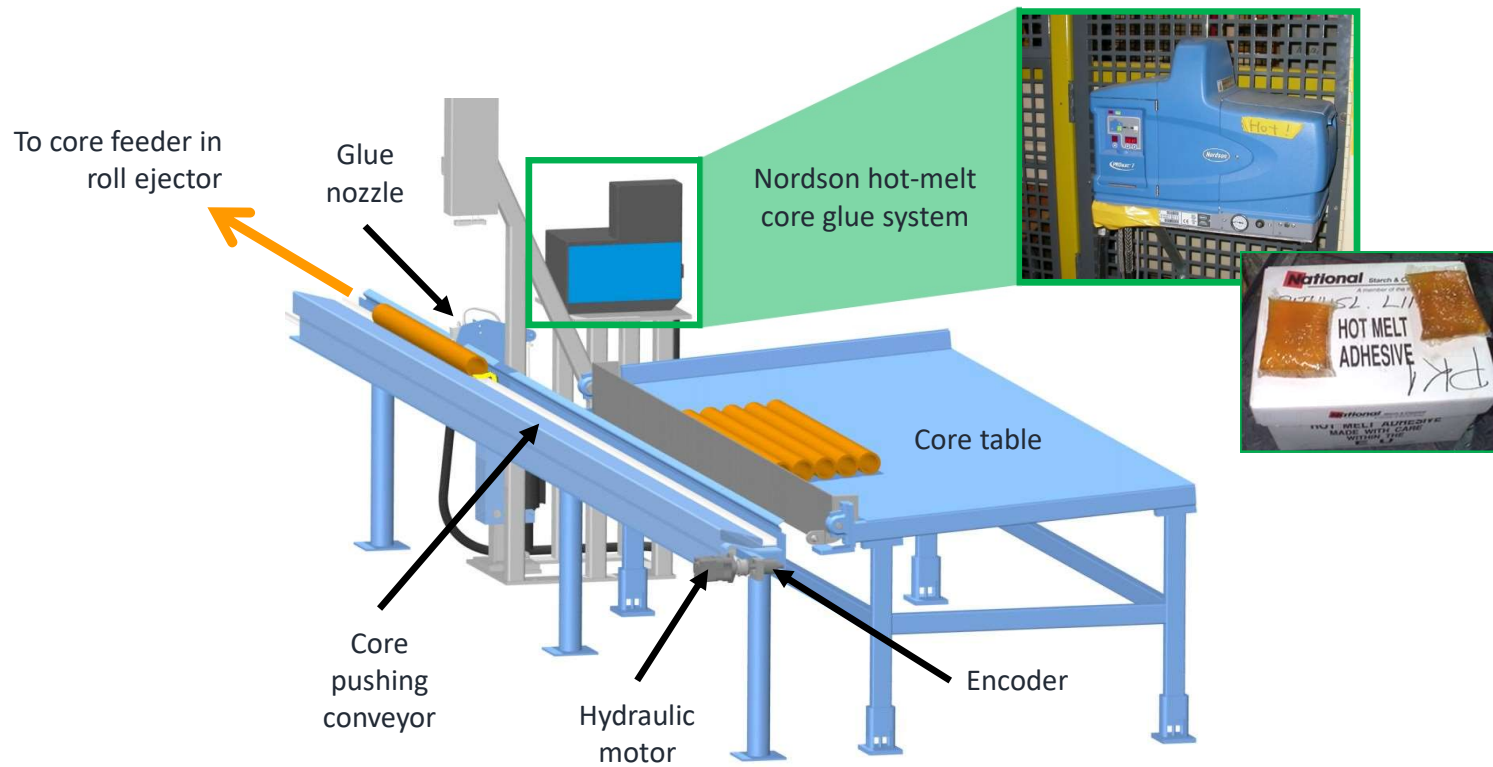
Automation of manual tasks

- Eliminate the risk by eliminating hands-on tasks.
- A few examples:
 - Set change including automatic sheet cut off, core feeding and core glue application
 - Automatic wound roll tail end glue application (eliminates discharge deck task of roll taping)
 - Auto-positioning slitters
 - Automatic trim ribbon cutters
 - Tail preparation / broke removal drive
- All of these automated upgrades both increase winder throughput and remove the operator from exposure to potential hazards.

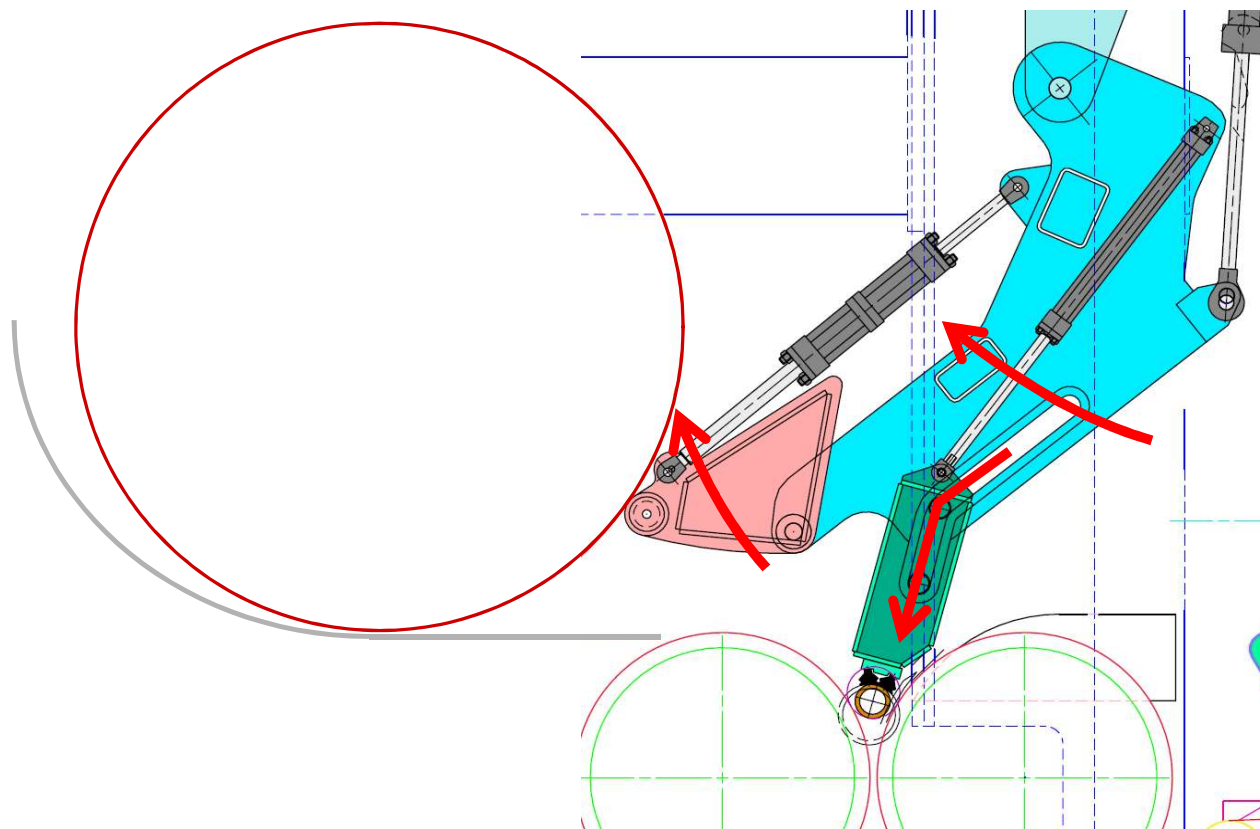
Set change web cutting position



Core feeding and gluing

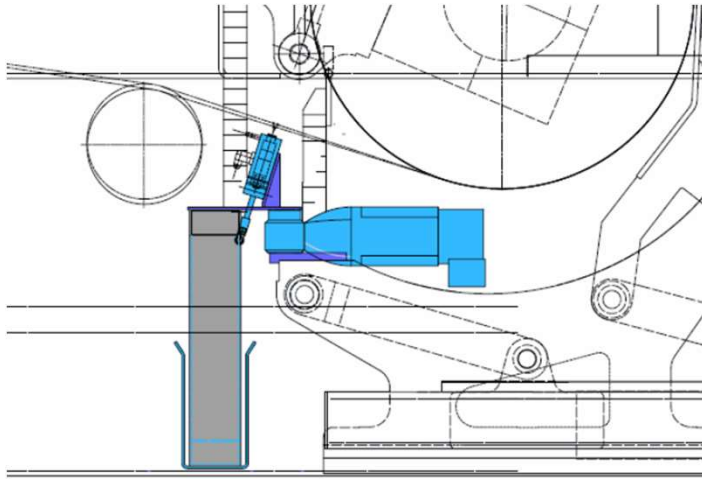


Full roll eject and vacuum placement of cores

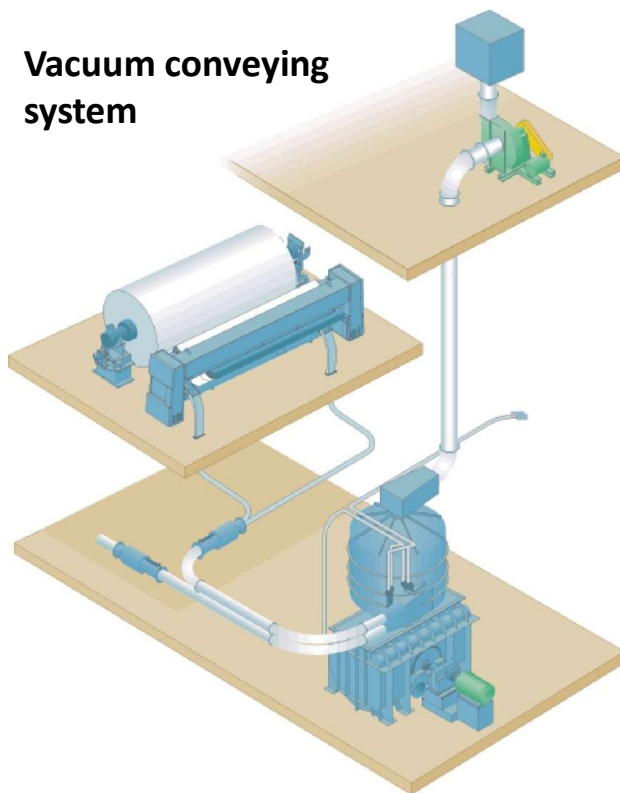


End gluing with traversing nozzle

Automatic gluing & less manual work



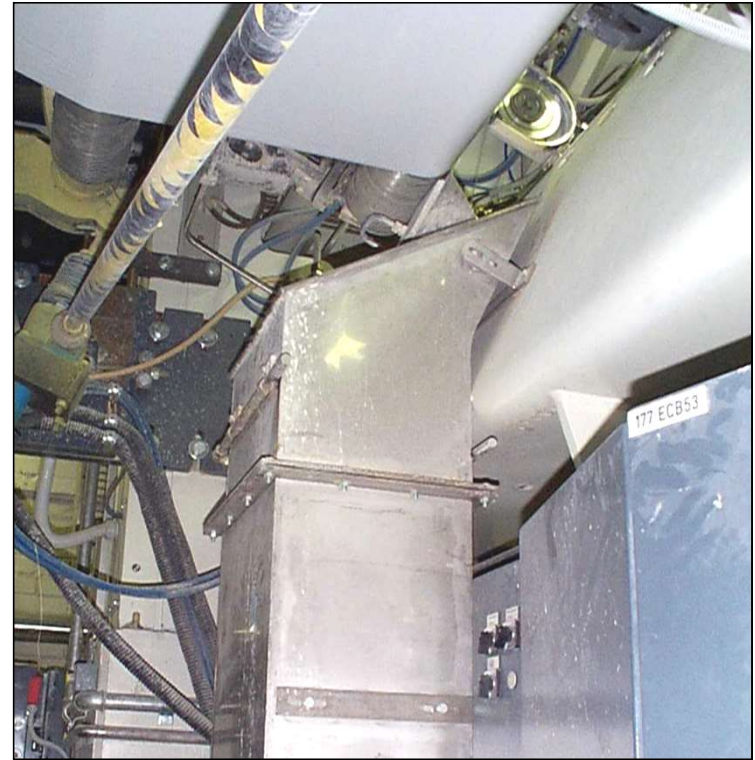
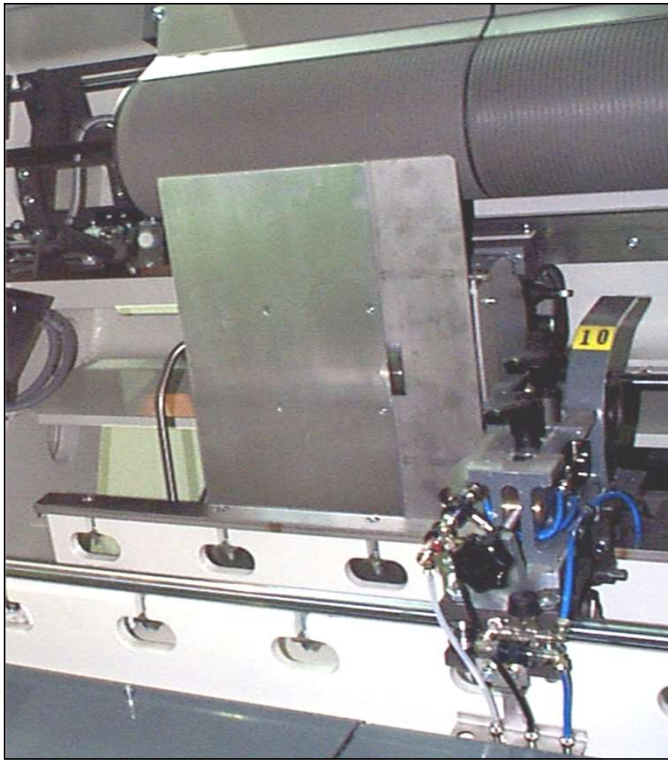
Trim ribbon conveying improvements to avoid winding but rolls



- Wider trim ribbons are needed to satisfy customer orders.
- Without flexible trim conveying, butt rolls are required.
- Tall narrow butt rolls can fall and injure operators.

Injector / ejector and chopper systems also available

Expansion of Trim Removal capacity



Examples of recent safety-driven winder upgrades

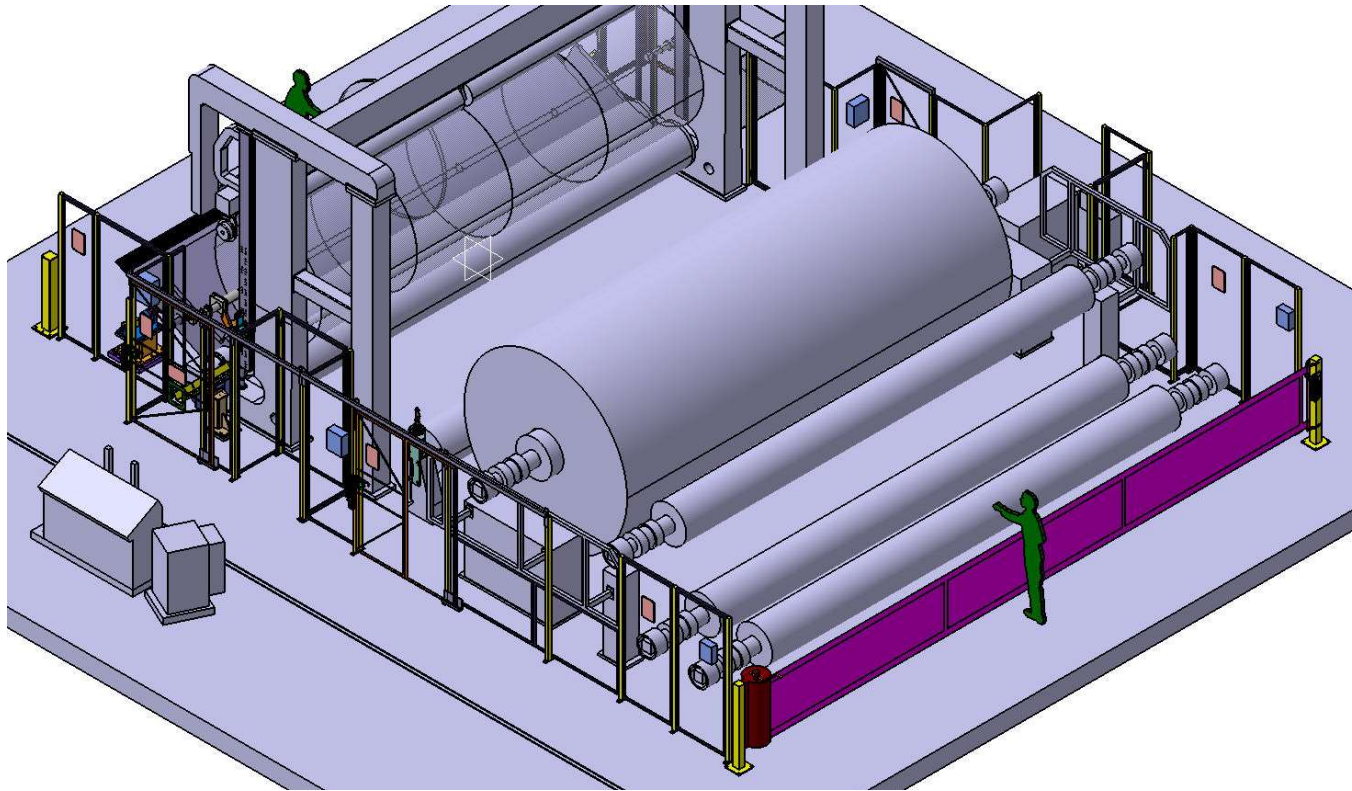
Southeast USA (Georgia) winder



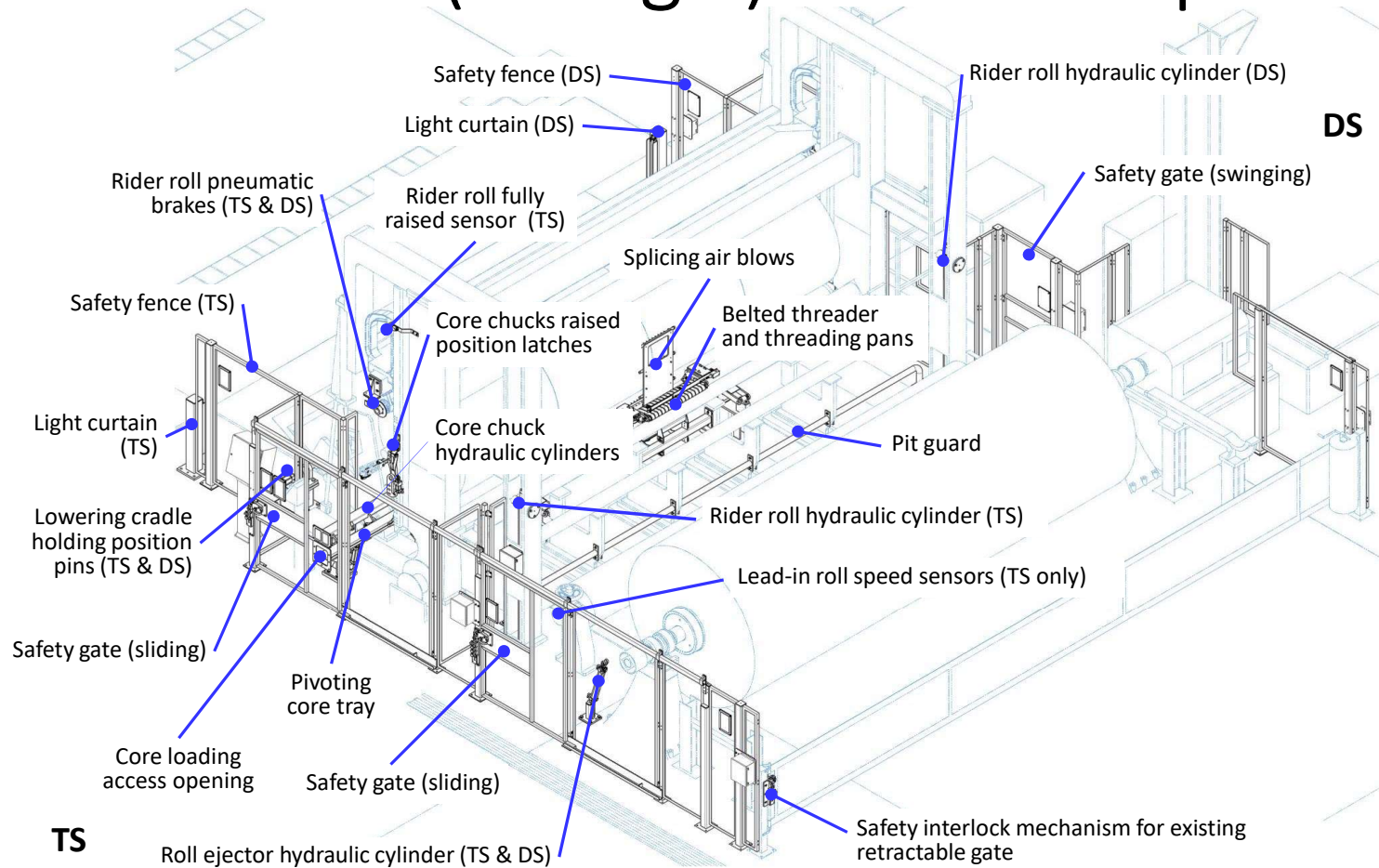
Photos before safety-based rebuild



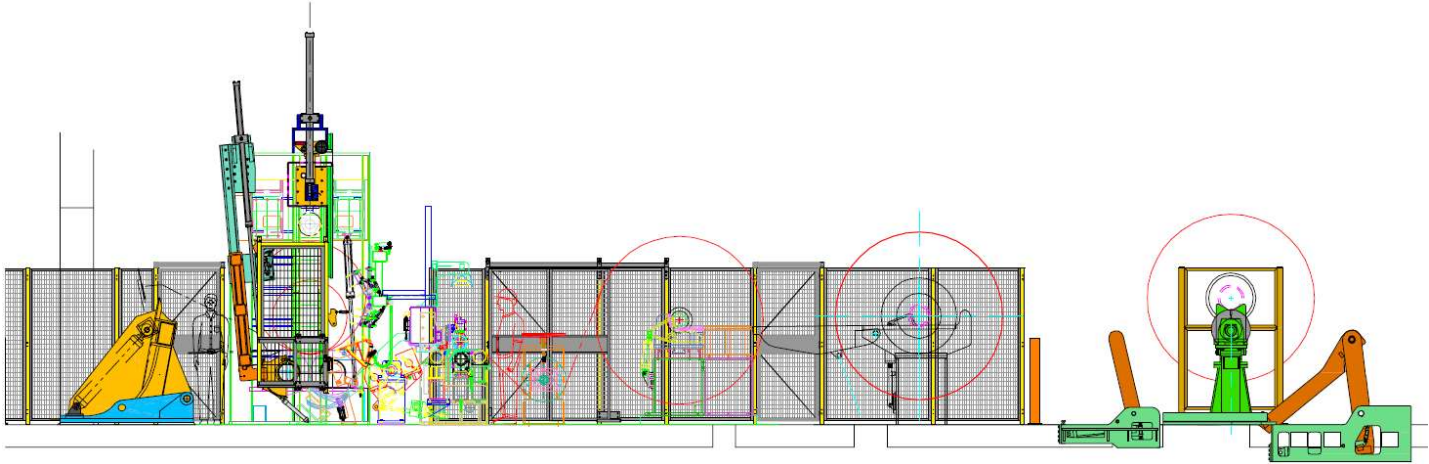
Southeast USA (Georgia) winder scope



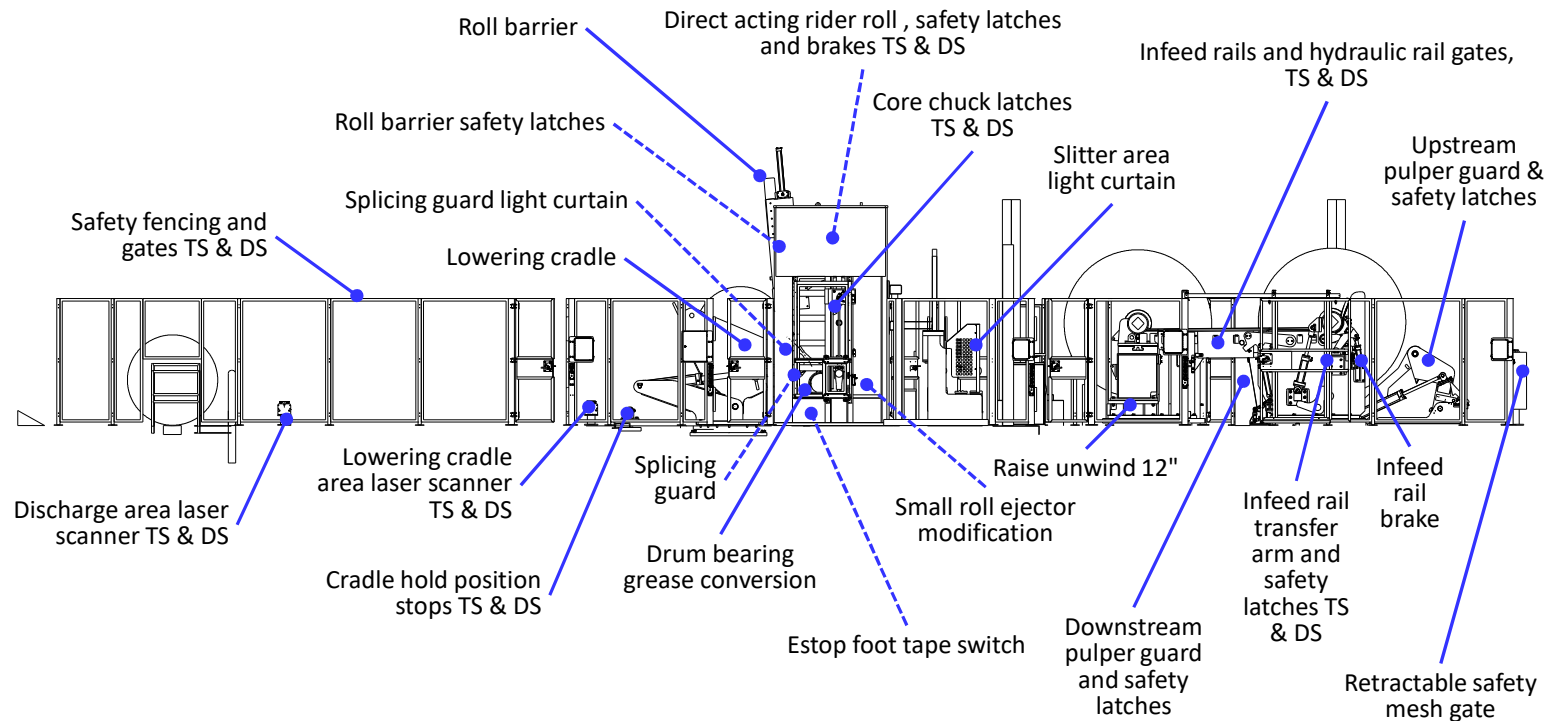
Southeast USA (Georgia) winder scope



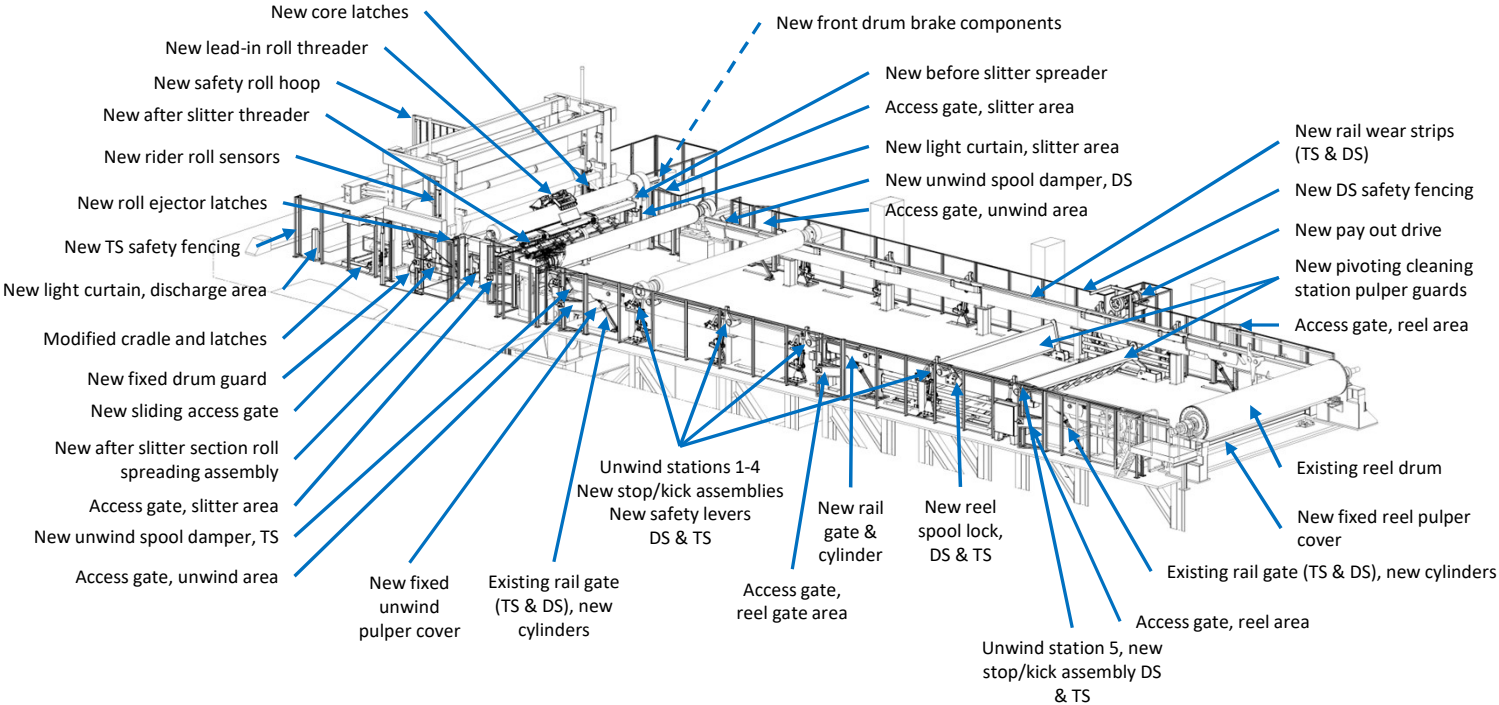
Southeast USA (Florida) winder rebuild



Southeast USA (Florida) winder rebuild



Midwest USA winder / infeed rebuild



Summary

- When tasked with developing a Winder Safety Improvement project:
 - Start with a clear level of safety that you expect the winder to reach at the completion.
 - Be aware that as you move up the "Safety Improvement Steps" you'll increase the level of safety, but also cost.
 - Strongly consider adding automated features to the rebuild to greatly decrease operator exposure to risks, and also insure overall winder capacity is maintained or improved.

Thank you for your
attention!

Any Questions?

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