



Preventative Maintenance Strategies for Elevator Legs

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Safety Moment

- A dropped belt can present a significant hazard
- Secure belt
- Stay out of the line of fire
- Open slowly
- Prepare for the worst



Agenda

Business alignment
Component reliability
Quantitative PMs
Hazard Monitoring
Q&A



Business Aligned Reliability

An equipment strategy to optimize profitability

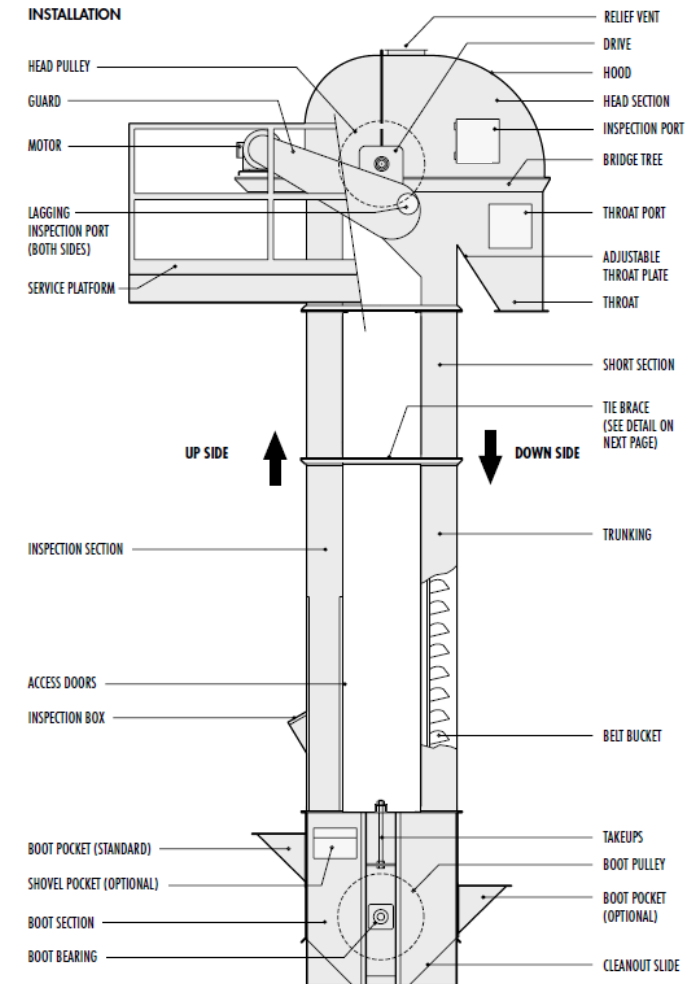
- What amount of uptime is needed
- Establish process safety schedule
- Turnaround timing or seasonal impacts
- R&M budgeting & staffing
- Expected asset life
- Capital investment
- Compliance and risk mitigation



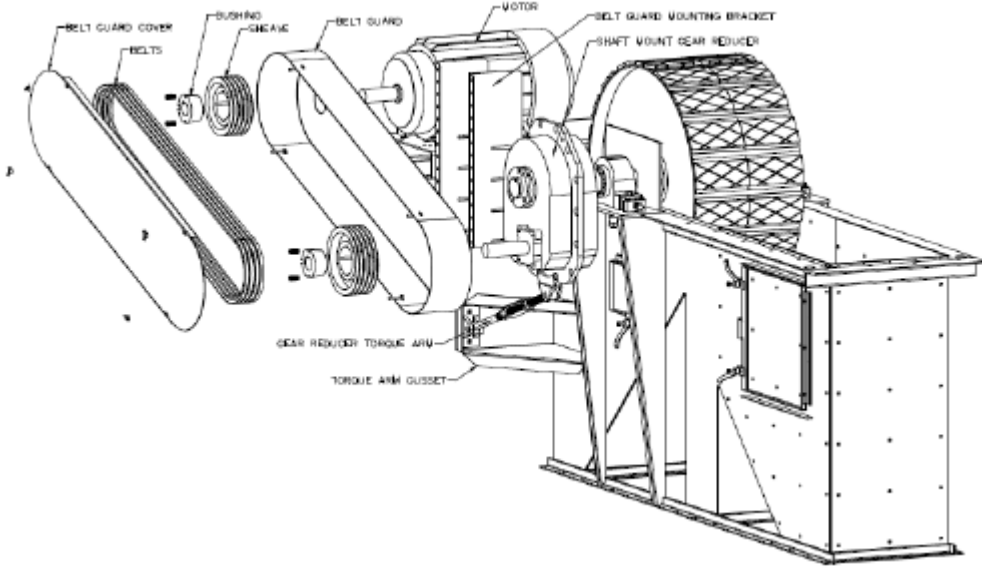
Bucket Elevator Leg

Recommendations

- Head Pulley lagging should be slide lagging
- Belt speed on new legs should be targeted at 650FPM
- Bearings should be pillow block
- Belting should be fire and oil resistant
- Adequate inspection doors on head and tail section
- Startup HP sized for full buckets and boot cleaned
- New installations should be equipped with explosion panels
- Backstops are preferred
- Explosion venting
- Avoid using metal buckets
- Full Haz-Mon system



Component Strategies



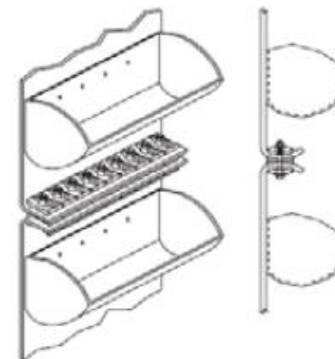
- Understand how and why each component can fail
- Develop inspections and PMs to address these failures
- Utilize technology and detailed inspections to measure equipment conditions
- Formally investigate failures
- Utilize precision maintenance during installs and repairs



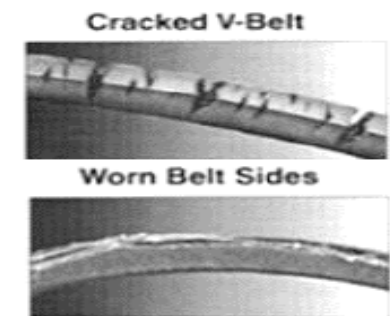
Buckets



Casing



Belting



Drive Components

Lubrication and Routes

Recommendations

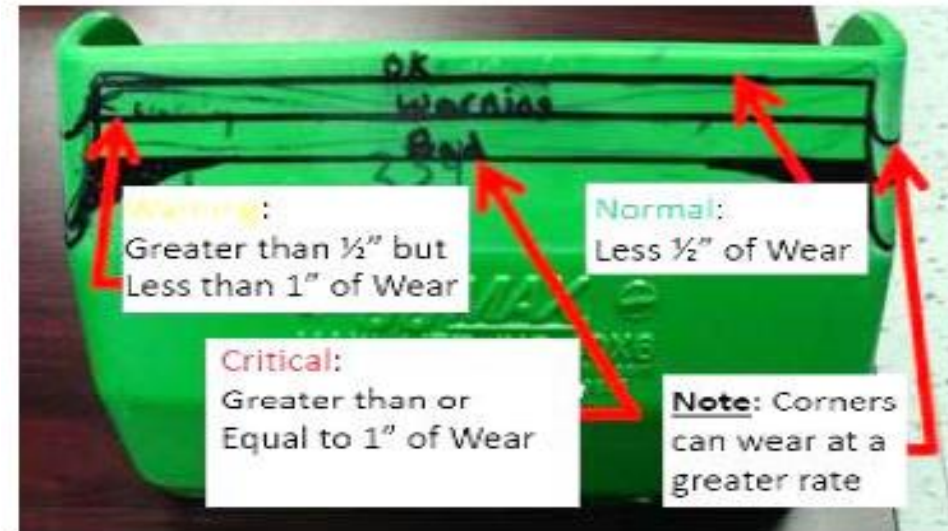
- Poor lubrication is common method of failure in rotating equipment
- Have the Right:
 - People, tools, lubricant, place, time, amount, process, and storage
- Utilize predictive maintenance tools in lube routes
 - Infrared
 - Ultrasonic
 - Vibration
- Have specific items to look for during daily/weekly routes
 - Housekeeping
 - Equipment condition



Inspection Points

Recommendations

- Belt – Centered on head and tail pulley
- Buckets - Damaged or missing
- Boot Pulley Shaft - Rotating properly under load
- Trunk - Striking or rubbing noises
- Back-legging
- Housing - Loose or missing bolts
- Decreased capacity
 - 14x7poly bucket with 1" wear on lip has lost 25% capacity



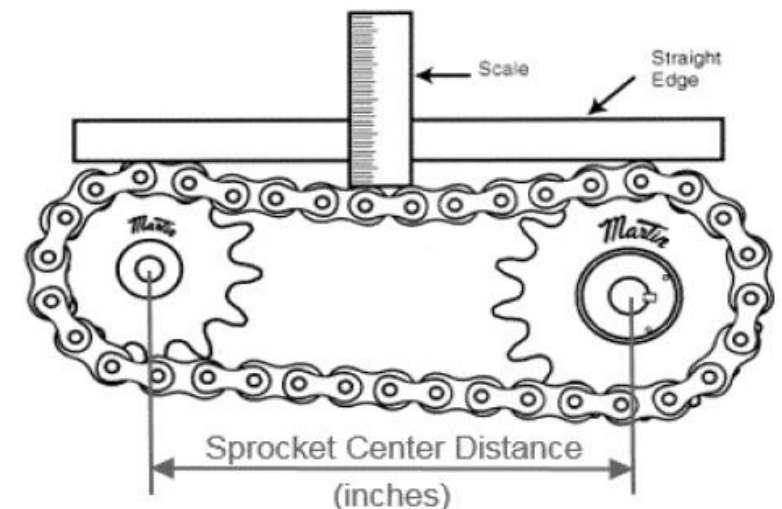
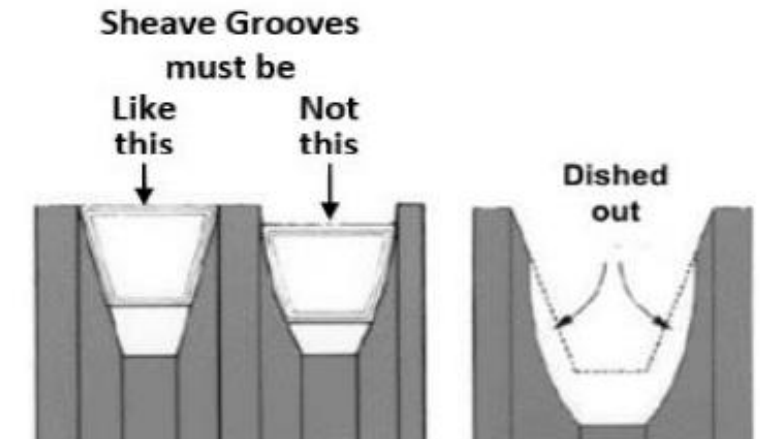
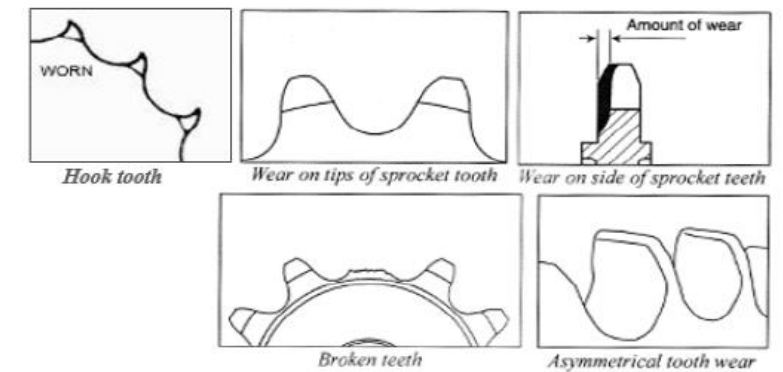
Precision Maintenance

- Utilize precision during inspections and repairs
 - Belt tensioning
 - Precision alignment
 - Tensioning and torquing
- Use data and thresholds to make decisions rather than visual observation and opinion
- Make PMs realistic and know the abilities of the people performing them
- Make it clear when to components needs replaced

Normal: Less than 1.5%

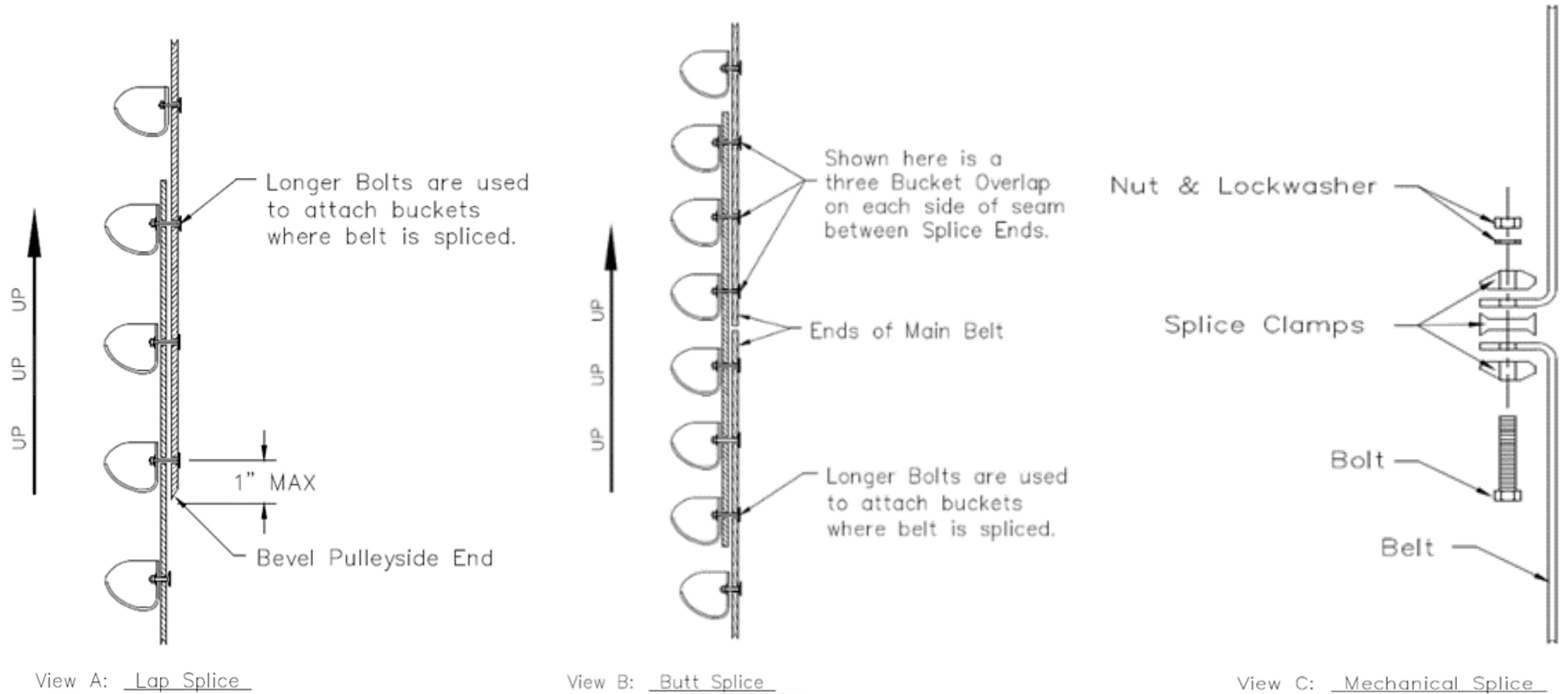
Warning: Between 1.5% and 3%

Critical: 3% or Greater



Belt Splicing

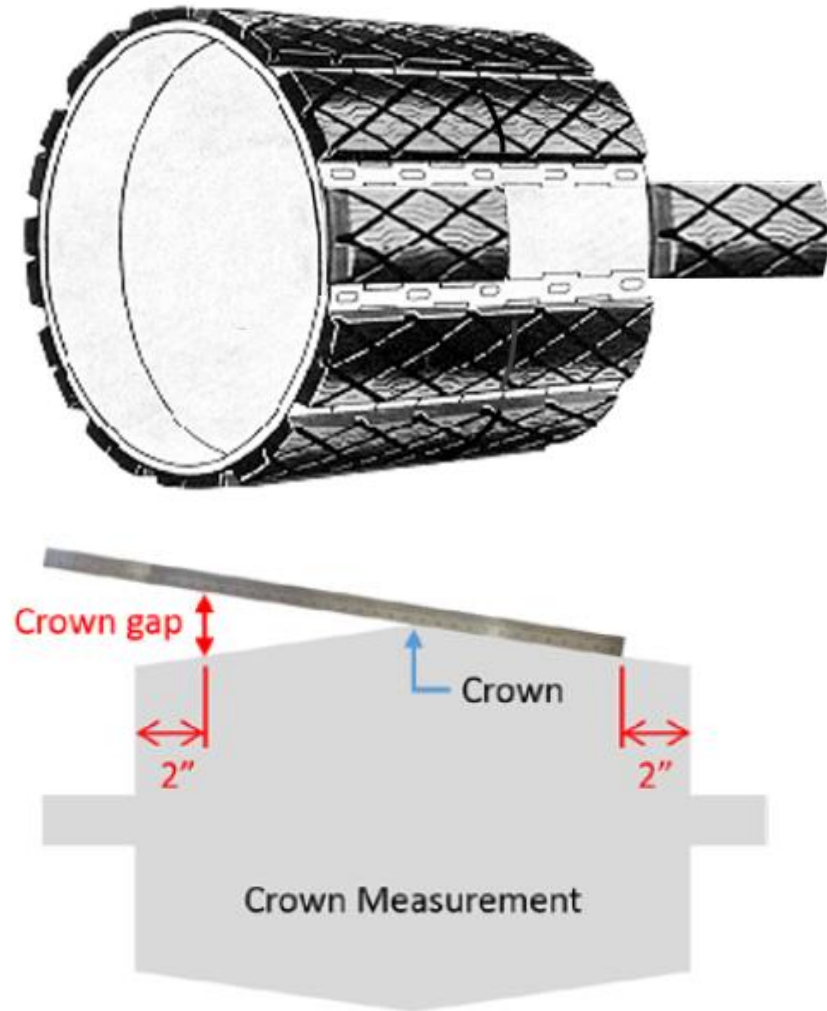
Recommendations



Head Pulley Lagging

Recommendations

- Use Slide lagging; Crown Edge lagging preferred
- Clips can be welded or bolted on
- Cut to length for pulley width. Cut in half to preserve crown.
- Size selection based on pulley diameter
- PMs should look for signs of deformation, cracking, and wear.
- Plan replacement when wear is between 25% and 50%



HAZMON Systems

Overview

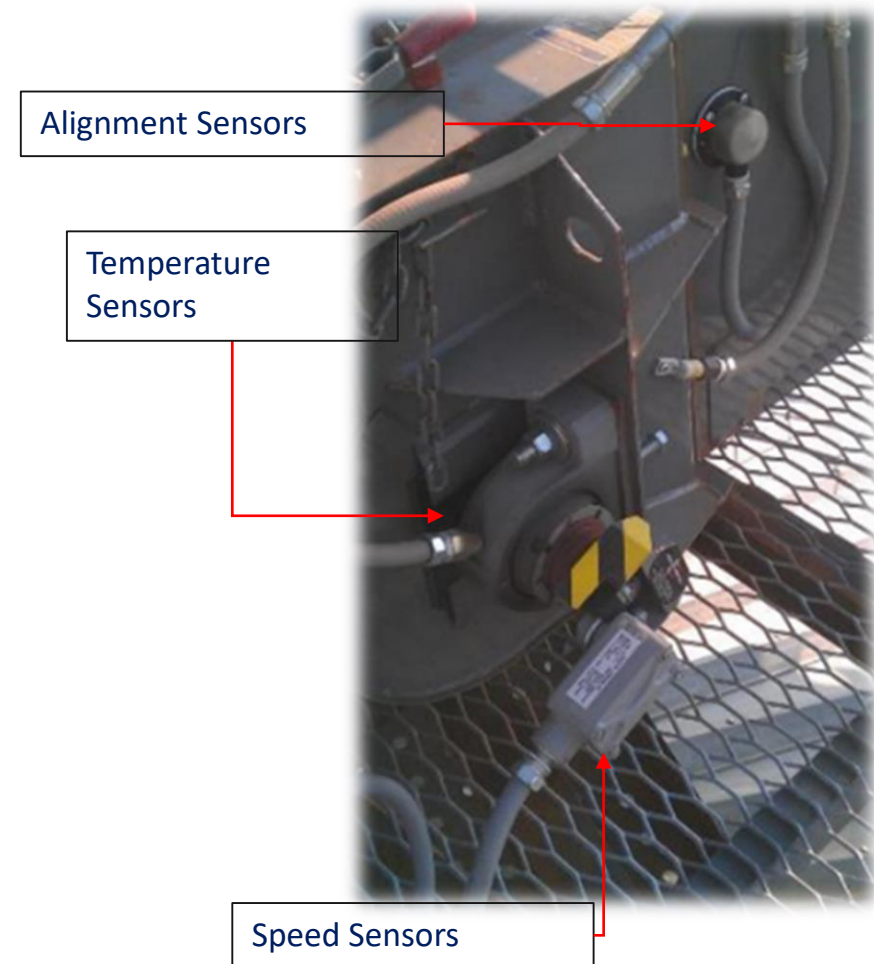
- Essential in preventing catastrophic property damage and injury from malfunctioning equipment
- Wired/programmed to automatically shut down the system
- Need maintained and tested
- Installation location critical



HAZMON Systems

Instrumentation

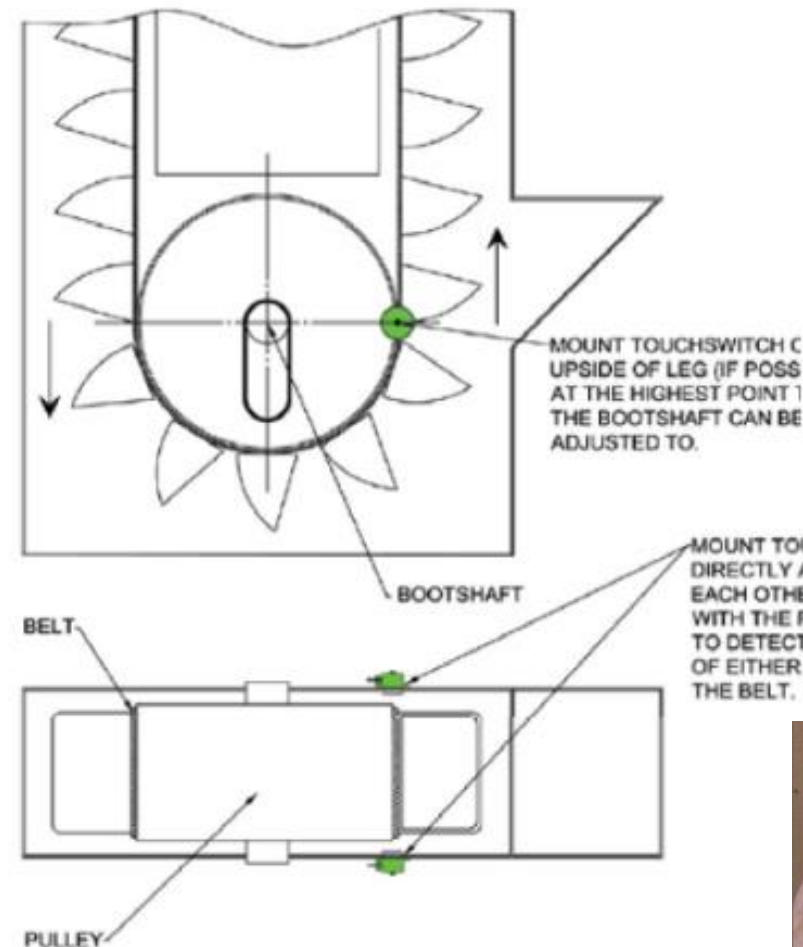
- Speed Sensors
- Temperature Sensors
- Alignment Sensors
- Plug Detection
- Vibration



HAZMON Systems

Installation

- Some leg boots will take more than one alignment sensor (per side) to catch belt and pulley throughout full travel of the boot pulley.
- Are alignment sensors directly across from one another?
- Do not assume contractors know the correct installation location for sensors.
- Can the alignment sensors be safely and easily inspected for wear?
- Are sensor terminations neatly made?
- Are speed sensors properly placed on a non powered pulley shaft (tail or boot shaft)?



HAZMON Systems

Inspections

Lid Switches

- Verify equipment shutdown when activated.

Plug Switches

- Verify equipment shutdown when activated.

Slack Chain

- Verify equipment shutdown when activated.

High, high level sensors

- Verify equipment shutdown when activated.

Interlocks

- Activate equipment interlocks to determine if a controlled shutdown of the equipment and interlocked equipment works properly.

Rub Blocks

- Freeze Spray to determine proper location on HMI or Hazard Monitoring Standalone Screen and Visual Inspection of Rub Block.

Touch Switches

- Manually rotate the external screw to pull in the puck and test the switch. Determine proper location on HMI or Hazard Monitoring Standalone Screen.
- Visual Inspection of Touch Switch for rubbing or product build up around the puck.

Temperature Sensors

- Use Freeze Spray to verify sensor is working properly.

Summary

- Business Alignment
 - What amount of uptime is needed?
 - What is the expected asset life?
- Develop a Component Strategy
 - Understand how will equipment fail
- Utilize good maintenance practices
 - PMs utilizing measurements
 - Precision maintenance
 - Predictive tools
- Establish operating procedures and policies
- Formally Investigate failures
 - Adjust PMs as needed
 - Focus on the root cause
- Audit performance and activities
 - PM compliance
 - Job cycle checks
- Create a culture of reliability and engagement



A low-angle, upward-looking photograph of several modern skyscrapers with curved, glass-enclosed facades. The buildings are made of a grid of dark metal frames and glass panels. A horizontal bar with segments of green, purple, blue, orange, and red is positioned across the middle of the image. The word "Questions?" is written in a white serif font on the left side of the image.

Questions?

Thank you

1902

Founding

1924

Listed on the NYSE

40,000

Employees

200

Countries Serving

450

Crop Procurement
Locations

330

Food & Feed Ingredient
Manufacturing Facilities

62

Innovation Centers

