Automated Saw Chip Collection System

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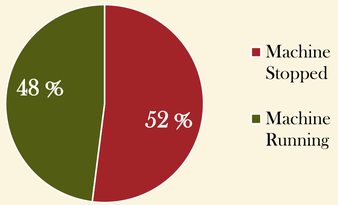
Objectives

- Decrease cleaning time
- Design for minimal operator input
- Design to reduce ergonomic risk to the operator



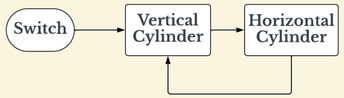
Engineering

Vertical Cylinder	Calculated (Nm)	Specified (Nm)
Mx	7.05	29
My	32.61	73
Mz	34.94	73

$\frac{7.05}{29} + \frac{32.61}{73} + \frac{34.94}{73} < 1 \rightarrow 1.16 > 1$

Horizontal Cylinder	Calculated (Nm)	Specified (Nm)
Mx	2.33	16
My	1.491	39
Mz	1.795	39

$\frac{2.33}{16} + \frac{1.491}{39} + \frac{1.795}{39} < 1 \rightarrow 0.23 < 1$

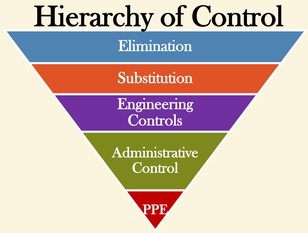


Operator pushes the switch, vertical cylinder moves down, initiating the horizontal cylinder cleans the chips and retracts back, finally the vertical cylinder goes back to home position

- Load Moment Factor (LMF) less than 1, represents a service life of 8000km
- Vertical cylinder has lower service life (6720 km)
- Total moment (static + dynamic) used to specify suitable cylinders

Safety

- **Administrative Controls**
  - Employee Training
  - Visual Aids
- **Engineering Controls**
  - Perimeter Guard
  - Emergency Stop Button



Overview

Background

Varying sized HSS tubes being cut on a vertical saw bed into desired lengths. Operators manually vacuum the chips to remove debris for easier handling in the manufacturing process.

Problem

Manual cleaning of shavings and chips from the tubes causes a production downtime.

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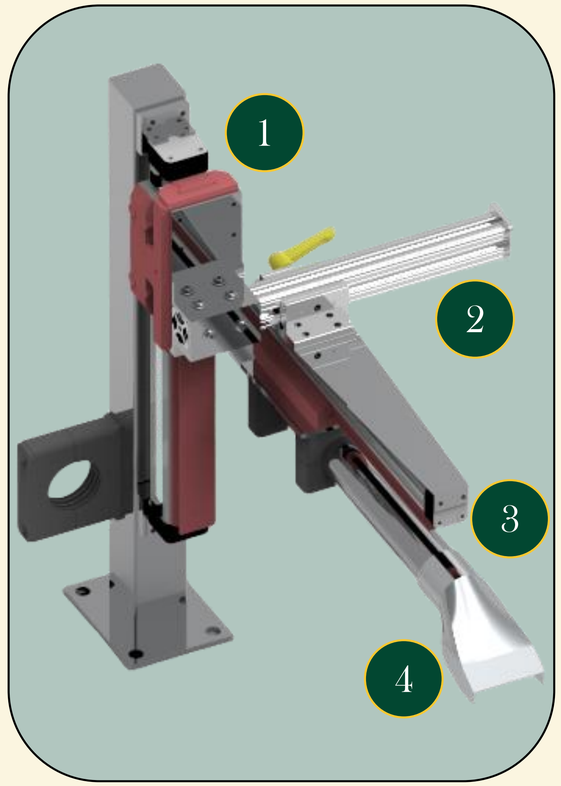
Solution

Automated saw chip collection system that involves multi-axis operation and minimizes operator input to vacuum debris after each cut.

Final Design



1) Vertical Cylinder

- One Motion: Up and Down
- Mounted on the cutting bed
- Holds the rest of the assembly

2) Adjustable Arm

- Equipped with a slider and brake
- Locks the Horizontal Cylinder to predetermined distances

3) Horizontal Cylinder

- Moves toward and inside the tubes
- Cylinder carries the vacuum hose and nozzle

4) Nozzle

- Interchangeable for quick maintenance
- Optimal nozzle design specifically for the application

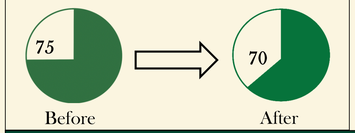
Design Specifications

- A multi-axis approach with motions in x, y and z directions
- Interchangeable nozzles to accommodate different sized HSS tubes and for maximum cleaning efficiency
- Speed of vertical cylinder (z-axis) – 10 in/s
- Speed of horizontal cylinder (x-axis) – 5 in/s

Effectiveness

	Current System	Designed System
Downtime per shift	65.28 minutes	32.8 minutes
Cleaning time per part	12 seconds	7 seconds
Cleaning Efficiency	97.54%	93.77%
% Downtime Reduction	**49.75%**	
% Efficiency Difference	**4.02% (Loss)**	

Current vs Designed Process Time (sec)



- Cycle time reduced by 5 seconds/part, resulting in 50% downtime reduction
- Daily downtime reduced by 32.48 minutes per shift

Proposed Cycle Time

Down							
Forward + Clean							
Reverse							
Up							
Time (sec)	1	2	3	4	5	6	7

Cost Analysis

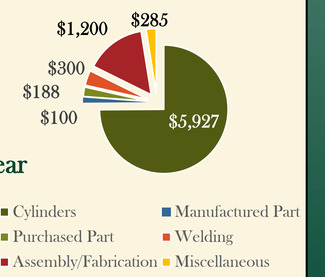
Cost Benefit Analysis

Total Project Cost $8,000

Production Days – 232 day/year
DT Reduction - 125.59 hour/year
Cost Benefit(50$/year) - **$6,300 / year**

Pay Back Period → **1.27 years**

Cost Break Down



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