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Project Overview

Background

Daimler Truck and Buses

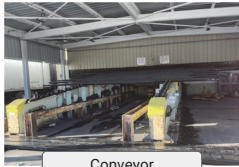
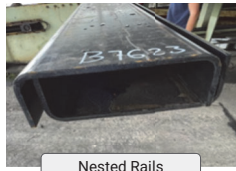
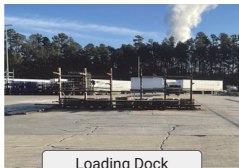
- 35+ locations
- Around 10,000 employees
- While the company makes seven vehicle brands, the Mount Holly location produces the Freightliner medium-duty Business Class M2/SD model as well as an ecoated cab for the Western Star units.



Objectives

- Execute an in-depth analysis of their frame rail denesting operation.
- Reduce downtime, increase productivity and create a more efficient cost-effective system.
- Design a method that will adjust the performance of the denesting machine and prevent any human or mechanical error that may occur during the operation.

Denesting Operation



Project Specifications

Specifications

- PS1: Reduce the average number of dropped frame rails per month by 80%.
- PS2: Operation will take no longer than 6 minutes to complete a denesting cycle.
- PS3: Ensure magnets do not exceed 180°F (82°C), causing a reduction in breakaway force.

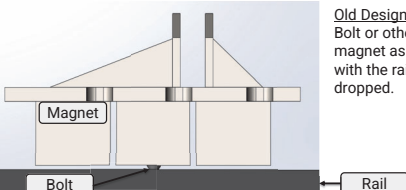
Scope

- Analysis of the process of the denesting operation.
- Design aims to reduce down time caused by heavy rails falling off the denester.
- The team will determine a solution that the budget will allow and reduce downtime as well as promote continuous processing.

Visualization of the issue

Old Design:

Bolt or other obstruction prevents entire magnet assembly from making contact with the rail. Resulting in the rail being dropped.

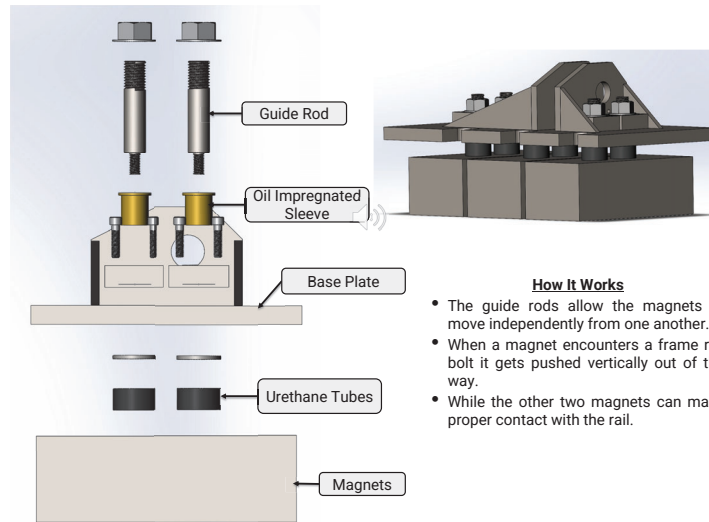
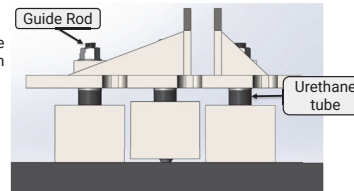


Design

Design Philosophy

Independent articulation of the magnets eliminates the likelihood that a bolt will prevent all three magnets from making contact.

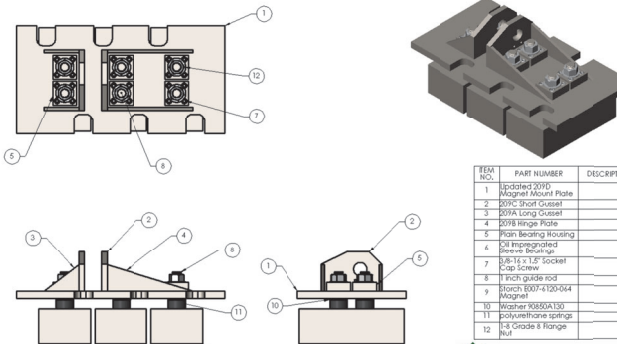
- Uses the existing magnet mount with minor changes to ensure compatibility with the machine.
- Only implemented on the top magnet mounts.
- Designed to make bearing and polyurethane replacement as easy as possible.



How It Works

- The guide rods allow the magnets to move independently from one another.
- When a magnet encounters a frame rail bolt it gets pushed vertically out of the way.
- While the other two magnets can make proper contact with the rail.

Engineering Drawing



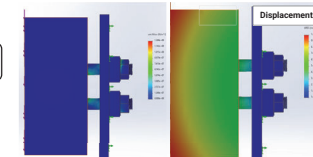
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Updated 2016	Magnet Mount Plate	1
2	509C Short Gusset		2
3	509A Long Gusset		2
4	507B Hinge Pin		2
5	Main Bearing Housing		6
6	Oil Impregnated Sleeve		6
7	3/8-16 x 12" Socket Cap Screw		24
8	1/2" guide rod		6
9	Item #P01430004	Magnet	3
10	Magnet MS00A100		6
11	polyurethane springs		6
12	1/4 Grade 8 Flange Nut		6

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Complete Assembly: Left Side
Dwg No: 0101 | Scale: 1:1 | Sheet 1 of 1 | Rev: 0 | 8

Testing

Guide Rods



- FEA with Solidworks Simulation using 1,000 lbf load per magnet.
- Max stress is 126.8 MPA and max displacement is 0.1090mm.
- Guide rods have a safety factor of 5.

Polyurethane Tubes

Durometer	500 lbf	1,000 lbf
90A	0.035"	0.116"
80A	0.060"	0.135"

Tested with valve spring tester

- Two different durometers of polyurethane were tested, 90A and 80A.
- The team chose 80A because it provided the best combination of deflection and durability.



- The guide rods had minimal deflection as designed.
- 80A polyurethane compressed as intended, allowing the magnet to remain in contact.

Implementation

Overview

- Steel parts were manufactured using CNC machining to ensure the parts were as precise as possible while minimizing material loss.
- Assembly was done by the team with assistance from Daimlers maintenance team.
- The assembly was installed by Daimlers maintenance team and tested on the rail present on the denester.
- The polyurethane deflected as expected when a bolt was on the frame rail which allowed the other magnets to attach to the rail as designed.
- The team used \$2,158 of \$3,000 given.

Implementation Pictures

