

Maintenance Trainers: Bearing Replacement & Sheave Alignment

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The Problem

Consolidated Grain & Barge (CGB) is in need of a practical means of training its new maintenance workers to be able to do the following:

1. Installation of pillow block bearings.
2. Adjusting conveyor belt drive systems with a laser guidance tool.

Background

Although the skills gained from using these simulators can be learned while on the job, more and more experienced maintenance workers are reaching retirement while more new workers are entering the field without experience. With this in mind, CGB needs a system that will allow them to train the new hires in an efficient matter.

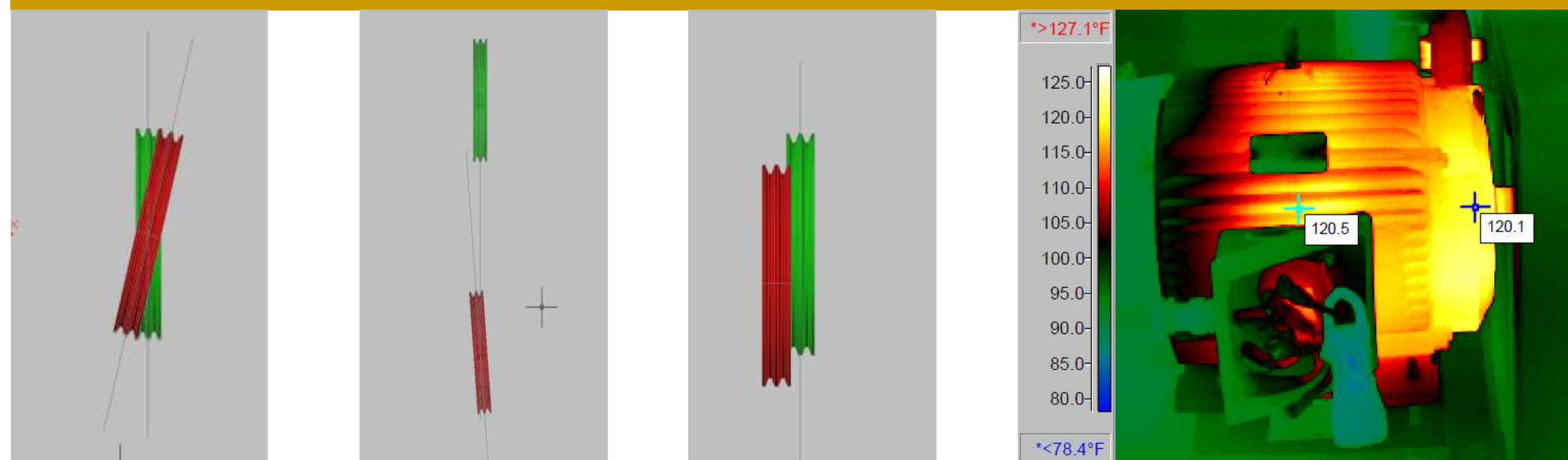


Figure 1.

Figure 2.

Figure 3.

Figure 4.

Figures 1-3 are the three forms of misalignment that can occur in a belt drive system, which are (1) belt twist, (2) pigeon toe, and (3) parallel offset. Figure 4. is a thermal image of a misaligned motor belt drive with temperatures in the range of 120 F. When properly aligned, shaft heat drops to 96.7 F at the motor and 98.5 F on the shaft. This loss in heat units can increase the life of bearings and motors significantly. Thermal image and information supplied by Advanced Maintenance Solutions.

Deliverables & Constraints

For this problem, we were asked to create training simulators for the following situations:

- Replacement of pillow block bearings
- Aligning a belt drive system with laser precision

We were also given the following constraints for the simulators

- The simulators need to be mounted on wheeled carts with floor brakes.
- They need to be small enough to fit in an enclosed trailer pulled by a pickup truck, and have the ability to be secured in place once inside.
- The simulators must be equipped with toolboxes.



Rexnord bearing equipped with SHURLOCK technology.



E-Z Align sheave alignment laser system.

Bearing Installation Simulator

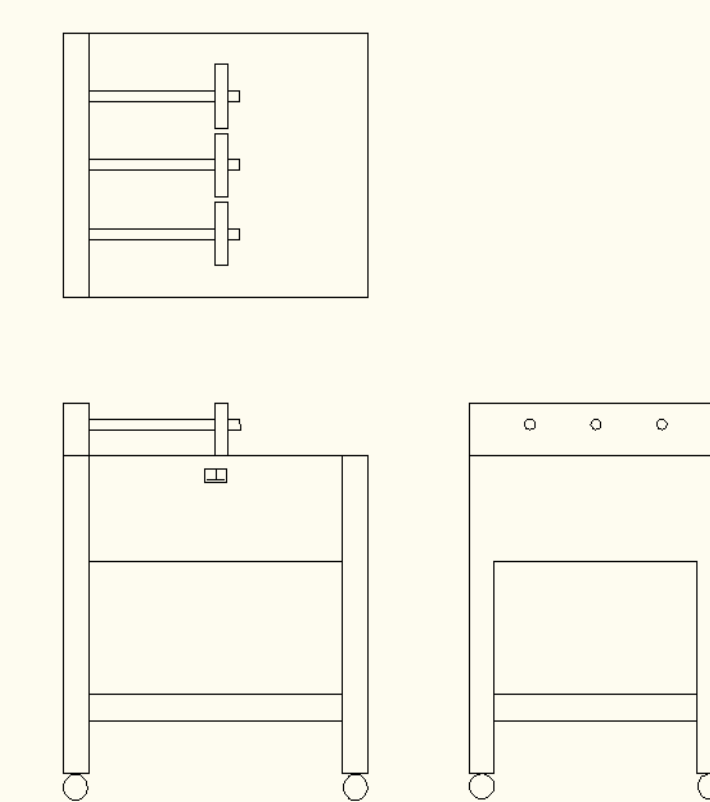


Figure 1 Bearing mounting simulator – Base design

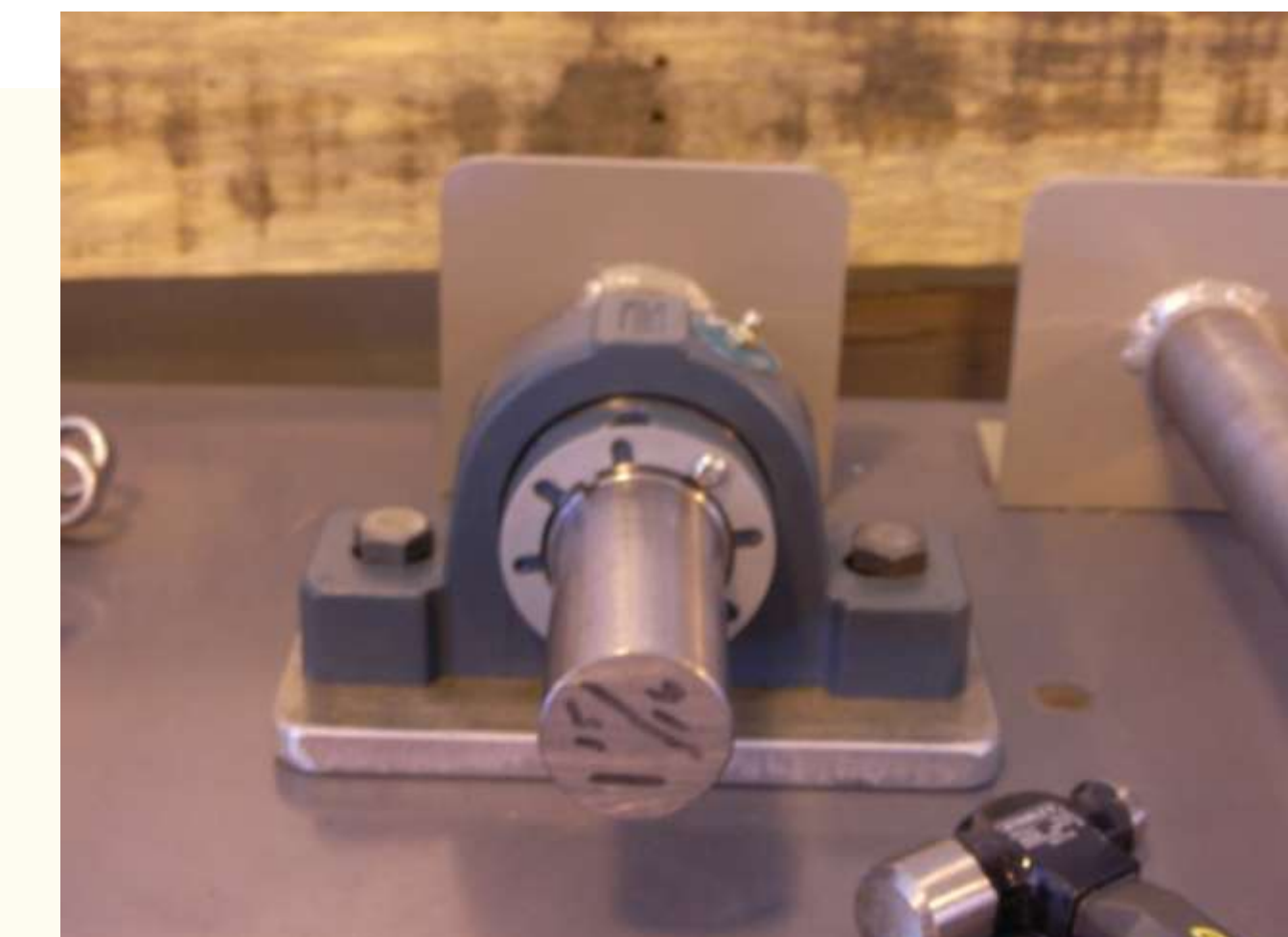


Figure 2 Bearing mounting simulator – Final product

Main Purpose

The main purpose for this simulator is for trainees to learn how to properly mount pillow block bearing while becoming familiar with the different bearing types that are most commonly used at CGB's facilities. Although it seems like a relatively simple task, there are certain restrictions that apply when choosing bearings in the field, such as the age of the machine, how long and often it runs, etc. This makes it necessary to know the installation procedures for each bearing design.

Base Design

This simulator was meant to create a situation for mounting different pillow block bearing onto one of three 1-15/16 inch shafts. The three simulations were as follows:

- One shaft of perfect size for standard bearings.
- One shaft slightly oversized.
- One shaft slightly undersized to simulate years of wear and tear.

Final Product

During the development, we stuck to our base concept, but were able to make some small changes. Although the basic idea was kept, the oversized shaft was removed from the design, since it wasn't realistic for one to exist. For the undersized shaft, we took a stock shaft and machined it down by 0.010 of an inch to simulate wear and tear. This would be used to train employees to mount newly-designed bearings that are equipped with a mechanism to secure the bore around the shaft while maintaining shaft-to-bore concentricity.

Sheave Alignment Simulator

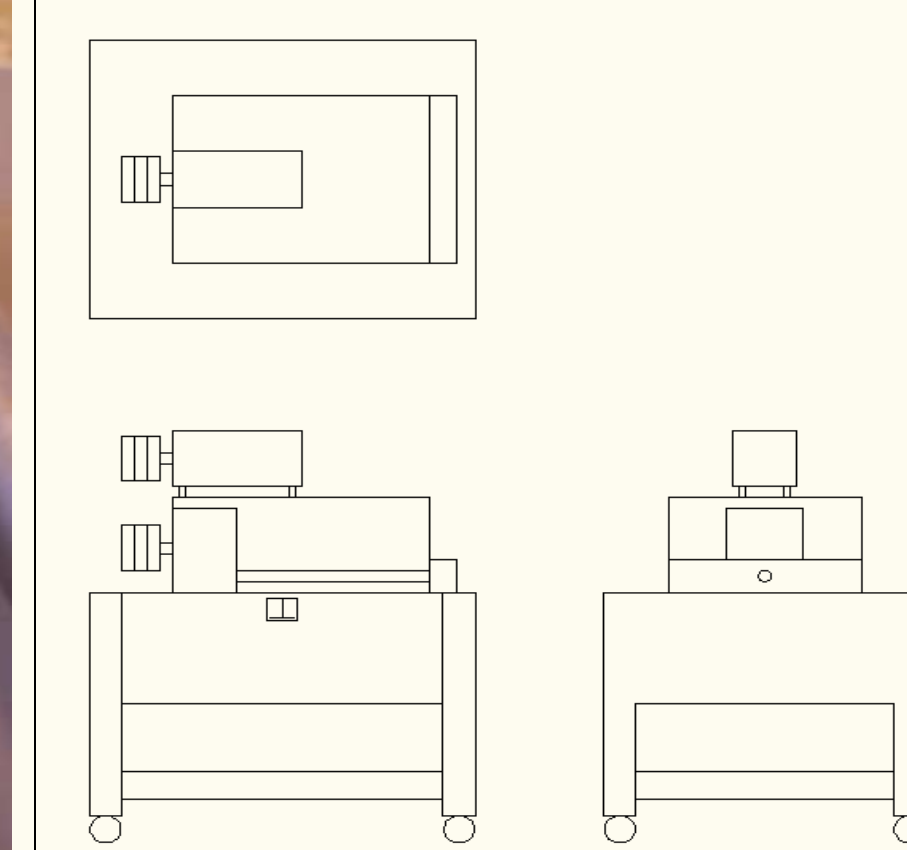


Figure 1 Sheave alignment simulator – Initial concept



Figure 2 Sheave alignment simulator – Final product

Main Purpose

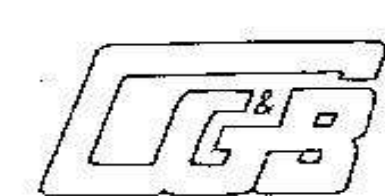
The main idea behind this simulation is for trainees to learn how to properly adjust belt drives on conveyor with the aid of laser technology. To make it simple, we are providing written instructions and guidelines to follow when making the adjustments so that the trainees can learn how certain laser patterns can tell them the sort of adjustments that are needed to have the belt sheaves properly adjusted.

Initial Concept

The main concept for this simulation was to have an unpowered 230/460 AC three-phase electric motor mounted to an adjustable platform and equipped with a four-inch belt sheave. This would be equipped with a belt that would be driving a nine-inch sheave connected to a stationary shaft, thus simulating a drive unit. Due to the fact that the main components of the drive system would most likely need to be heavy-duty, we had assumed that we would need to build our own service truck.

Final Product

Thanks to GSI, we were able to get an entire drive end from a drag conveyor for the simulator. However, due to its length, we had to cut two feet off of the tail end of the conveyor chute. However, we were able to get the motor that we needed. Also, once we had a look at the drive unit, we were able to avoid order a pre-made heavy-duty service cart along with a stocked toolbox. However, one minor issue we had with the conveyor was that the original torque arm bracket was too large to be mounted to the cart without compromising its weight capacity. Since the torque arm bracket assembly was not a critical component to the simulation, we fabricated a smaller bracket that fit to the cart more practically.



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Technical Advisor: Dennis Buckmaster, Associate Professor, Purdue University

