

AR No. 3

Metal Detection

Recommended Action

Metal in the wood trim going to the chipper causes approximately thirty minutes of production downtime per day. A magnet separator prior to the vibrating conveyor will remove metal from wood scrap, reducing downtime. The reduction in downtime can potentially increase profit more than \$100,000 per year.

Assessment Recommendation Summary			
Production Increase	Cost	Implementation	Payback
(mbf)	Savings	Cost	(years)
3,600	\$116,900	\$20,000	0.2

Background

Metal from broken saw teeth, objects embedded in trees and various scraps accumulated on the production line often ends up in the wood trim going to the chipper. A detector on the conveyor to the chipper scans for foreign metal and shuts down the line to prevent damage to the chipper. Once the metal detector goes off, the entire production line shuts down and two employees leave their stations to search for the metal. An average of 30 minutes per day is spent looking for metal pieces in the conveyor system, which decreases mill productivity.

Many companies that produce heavy lifting magnets, such as those used in scrap yards and loading docks, also manufacture smaller-scale magnetic separation equipment. Magnetic separation has been used successfully and for many years in the wood processing industry to remove metal from trim and waste streams. A unit can be installed in your process to remove damaging metal while minimizing downtime.

Anticipated Savings

Savings will result by increasing actual production time by 30 minutes per day (approximately 15 minutes for each shift). This can be quantified from the sale of more lumber coming off the production line. Plant personnel indicated that there was sufficient market demand to support increases in production. Therefore, we assume that all increased production will be sold.

Annual downtime (AD) due to metal detection is calculated as the average daily downtime (DD) multiplied by the number of operating days (OD) per year.

$$\begin{aligned}
 AD &= DD \times OD \\
 &= 0.5 \text{ hr/day} \times 251 \text{ days/yr} \\
 &= 125.5 \text{ hr/yr}
 \end{aligned}$$

The production rate (PR), excluding downtime, is calculated by subtracting the annual downtime from the total operating hours (OH) and dividing this value by the current annual production (AP) of 111,500 mbf/yr.

$$\begin{aligned}
 PR &= AP \div (OH - AD) \\
 &= 111,500 \text{ mbf/yr} \div (4,016 \text{ hr/yr} - 125.5 \text{ hr/yr}) \\
 &= 28.7 \text{ mbf/hr}
 \end{aligned}$$

Production increase (PI), assuming elimination of downtime associated with metal detection, is calculated by multiplying the current production rate by the annual downtime.

$$\begin{aligned}
 PI &= PR \times AD \\
 &= 28.7 \text{ mbf/hr} \times 125.5 \text{ hr/yr} \\
 &= 3,600 \text{ mbf/yr}
 \end{aligned}$$

Based on your records, the sales value of lumber is approximately \$330/mbf. Assuming 10% profit margin (PM), the profit increase (PI) will be:

$$\begin{aligned}
 \$PI &= PI \times \$/\text{mbf} \times PM \\
 &= 3,600 \text{ mbf/yr} \times \$330/\text{mbf} \times 10\% \\
 &= \$118,000
 \end{aligned}$$

The operating and maintenance (O&M) expenses for the magnet separator will offset savings. We assume that additional energy consumption by the magnetic separator is negligible. An estimated annual O&M cost of \$1,100/yr, 10% of the equipment cost, will be used for this recommendation. Annual savings are summarized in the following table.

$$\begin{aligned}
 OM &= \$11,000 \times 10\% \\
 &= \$1,100
 \end{aligned}$$

Savings Summary		
Source	Quantity Units	Cost \$
Production Increase	3,600 mbf	\$118,000
Operation and Maintenance		(\$ 1,100)
Total		\$116,900

Implementation Costs

This recommendation requires the purchase and installation of a suspended magnetic separator. Average base cost for a permanent magnet separator suited for a 15-inch wide belt is \$5,000. Average base cost for electromagnet separator suited for a 24-inch wide belt is \$11,000. An implementation cost figure of \$20,000 was generated as a high-end conservative cost estimate using the larger electromagnet separator price. Installation and employee training costs of \$2,000 and \$7,000, respectively, are also included in the implementation cost. These values were obtained from vendor estimates and assumptions of employee training requirements. A breakdown of the implementation cost are found in the following table.

Implementation Cost Summary			
Item	Quantity	Unit Cost	Total Cost
Magnetic Separator	1	\$11,000	\$11,000
Installation	1	\$2,000	\$2,000
Employee training	1	\$7,000	\$7,000
Total			\$20,000

The savings will pay for the implementation cost in 0.2 years.