

PROCESS IMPROVEMENT OF INDUSTRIAL HEAT TREATMENT OF AMMUNITION CASES

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Abstract

The focus of the project is to reduce wastewater and process steps in the manufacture of ammunition cases. The manufacturing process includes multiple stamping and pressing, washing, and heating steps, all of which impact the facility's overall water usage. The project team analyzed each of these steps to reduce the number of overall process stages and to find ways to minimize water usage and wastewater generation.

Rimfire Case Making Process

Brass case making consists of three coldworking stages and two thermal processing stages. As the case is formed, it becomes work hardened causing stress in the crystal lattice that must be relieved to prevent splitting or cracking. Annealing is done at high temperatures to allow the crystal structure to relax back to a lower energy state.

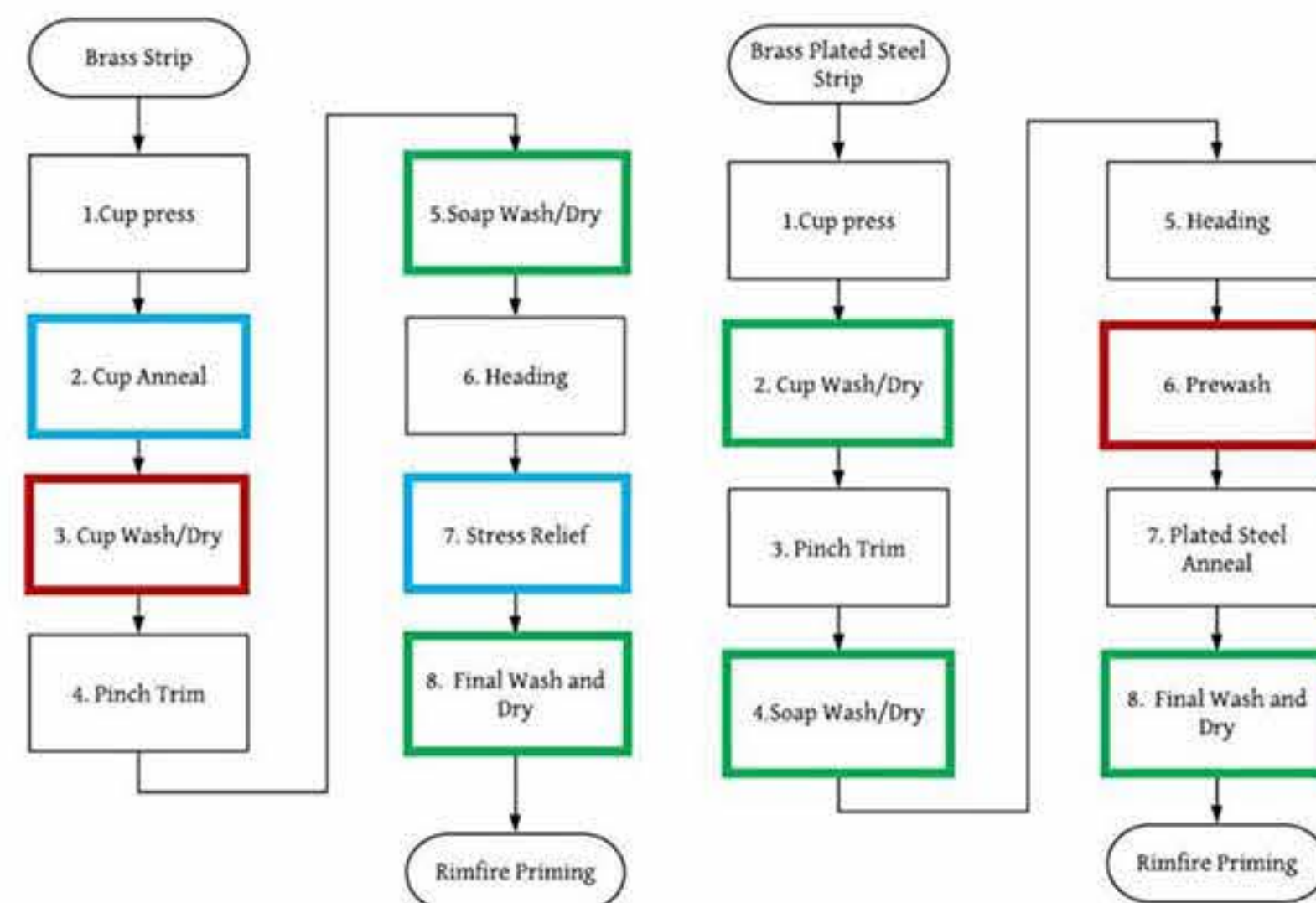


Figure 1: Functional diagram of the process steps used in the production of rimfire brass and brass plated steel cases. Highlighted process steps were evaluated in this project (Blue-replacement furnace; Green-new inline washer; Red- eliminated).

Exothermic Gas

Operating the furnaces under an exothermic gas atmosphere has the potential to eliminate the corrosion that is currently being generated in these steps of the process. Figure 2 demonstrates the difference between annealing under atmospheric air and under an exothermic atmosphere.



Figure 2: Part on the left are annealed under atmospheric air while parts on the right are annealed under an exothermic atmosphere.

Proposed Packages

Package 1	Package 2	Package 3
Cooling Tower (blue)	- Annealing Oven (blue) - Belt Cooler After the B Oven (blue) - Rotary Drum Cleaning System (green & red) - Exo-gas Generator (blue)	- Annealing Oven (blue) - Stress Relief Oven (blue) - Rotary Drum Cleaning System (green & red) - Exo-gas Generator (blue)

Table 1: The equipment breakdown for the proposed packages with color indicators that associate the equipment with the affected process steps (Figure 1).

Economic Analysis

The economics of the three options were compared leading to the recommendation of Package 3. The expected capital investment of the proposed package is \$1,197,054 with an expected annual benefit of \$418,606.

	Package 1	Package 2	Package 3
Fixed Capital Investment	\$53,659	\$1,043,804	\$1,197,054
Annual Savings	\$110,262	\$332,220	\$418,606
ROI	205%	32%	35%
IRR	205%	18%	22%

Table 2: A cost summary of the three packages with their respective first-year return on investment and internal rate of return for a five-year investment.

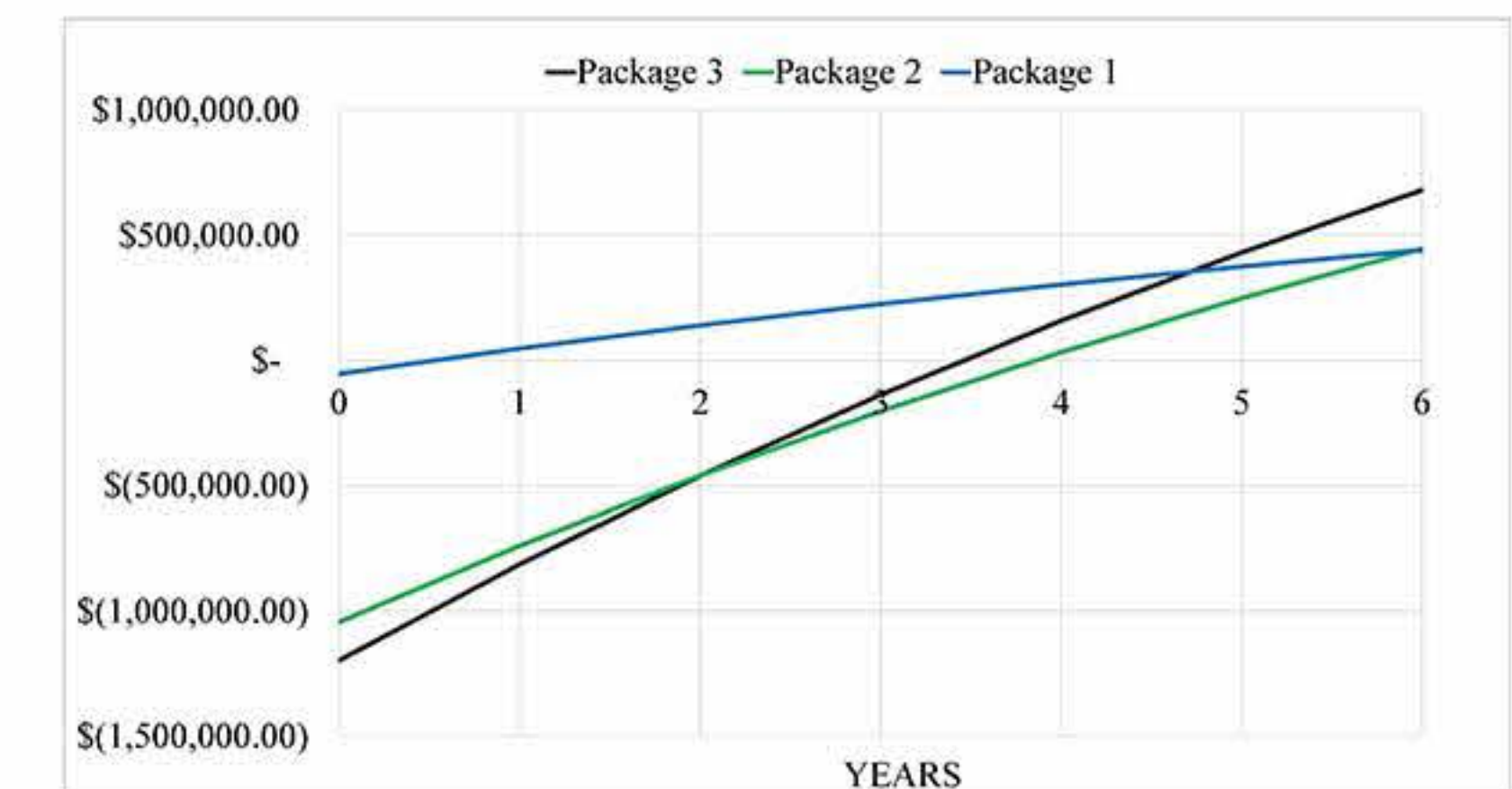


Figure 3: Discounted cumulative cash flow projections for three wastewater reduction packages.

Conclusion

- The recommended option is Package 3 because it is more profitable than the other packages after 5 years
- Wastewater discharge reduced by 28,618,757 gallons per year
- Total capital cost of \$1,197,054
- Saves a total of \$418,606 per year

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