

WMR: Filter Cleaning System

Project Description

Western Metals Recycling uses large cylindrical air filters to collect dust from their recycling line. These filters are swapped out and cleaned at approximately 2-week intervals and each cleaning cycle currently costs \$5,000.

Requirements:

- Clean 80 filters in 2 hours
- Cost-effective maintenance
- Easy cleanup after a complete cycle
- Lifting less than 50 lb
- Produce less than 80 decibels of sound
- Operable with minimal training

Constraints:

- Waterless cleaning method
- Produces no visible dust emissions
- Transportable with forklifts
- Operable both indoors and outdoors



Design Description



Design Render

Key Design Choices:

- 2 cleaning bays per cabinet
- Removable dust collection bin
- Compressed air to clean filters
- Motor driven filter spinning
- Scalable cabinet design concept



Final Product

Performance Review

- SolidWorks CAD inspections
- Filter cleaning tests

Requirement/Constraint	Target	Threshold	Predicted Performance	Actual Performance
Lifting force required for personnel (lb)	30	50	30	30
Lifting height required for personnel (in)	30	48	46	44
Noise level (dB)	65	80	80	75-80*
Size of machine (in*in*in)	96x96x72	144x96x72	72x60x60	-
Dust emission (MERV)	12	9	12	-
Skid weight (lb, each)	3000	6000	3000	-
Time to clean 80 filters (min)	<120	120	107	-
Variable cost (\$)	\$100	\$200	\$200	-
Number of operators		1	1	1
Operating temperature range (F)		0-100	0-100	-

*This value represents data when the system was operated with shop vacuums



Conclusion

Lessons Learned:

- Higher pressure compressed air cleans the filters faster
- The current blower is too strong and must be throttled
- The current system clean the filters in approximately 6 minutes versus our desired time of 9 minutes
- Certain part designs complicated manufacturing and assembly
- Number of unique parts that must be manufactured was lowered

Recommended future work:

- Install controls on the blower and add a regulator to the compressed air inlet
- Design a skid to hold the entire system to make moving it with a forklift easy
- Raise the overall height of the unit to increase the size of the dustbin and to prevent the air bars from blowing the debris around
- Improve on the filter box design to improve its efficiency

