To Predict ▶ To Design ▶ To Perform

College of Engineering
Department of Mechanical & Industrial Engineering

ME, ECE, IE Capstone Design Programs

Team 2: Pleated Filter Frame Technology

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Air-Nu FILTRATION – OUR ONLY BUSINESS

Background

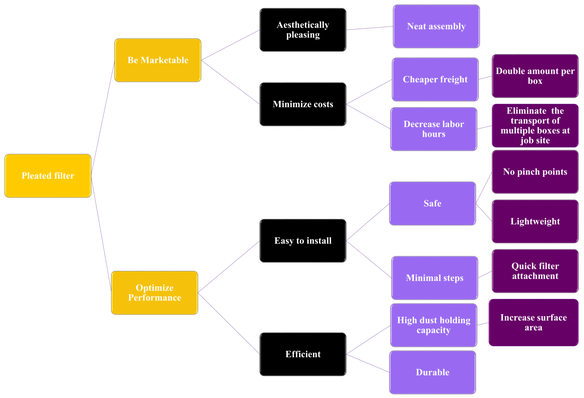
Design a reusable filter frame to cut costs by:

- ➢Less material
- ➢Lower shipping costs
- ➢Reducing labor costs

Industrial Filter Rack

Final Prototype in Rack

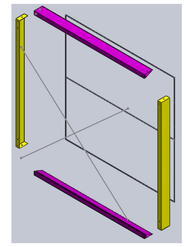
Objectives



Engineering Specifications

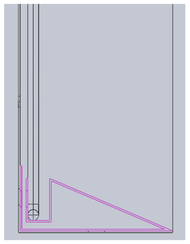
Specs	Value	Results
Surface Area	11.3-17.5 ft^2	12.3 ft^2
Weight	<5 lbs.	3.44 lbs.
Pleats/foot	~15	17
Final Resistance	2.0" W.G.	✓
Dirt Holding Capacity	1.57-2.46 Oz/ft^2	✓
Filter Depth	2"	✓
Installation Time	< 2.5 min.	30.6 s
Max Drop height	7.43 ft	✓

System Overview



Qualities:

- Quick to Install
- Durable
- Can withstand 40 lb. transverse force
- Light Weight

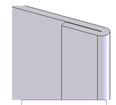


Safety:

Minimize sharp edges → Safety edges

Lightweight → No lifting injuries

Minimize pinch points → Small clearances



Safety Edge

Engineering Analysis

- Stress analysis from flow on:

Support members

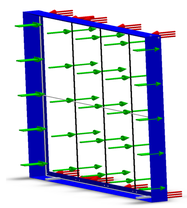
$$\sigma = \frac{32M}{\pi d3}$$

Back frame walls

$$\sigma = \frac{Mc}{I}$$

Rivets

$$\sigma = \frac{F}{A_x}$$



Distributed Load from Airflow

- Installation time and Weight
  - 10 runs recorded
  - Average & Standard deviation computed

Manufacturing Plan

Prepping Process

·Cut metal

·Bend with sheet break

·Drill holes for rivet inserts

·Outsource lock-in plate

Assembly Process

•Attach sides at corners using 2 rivets

•Attach support rods in X configuration

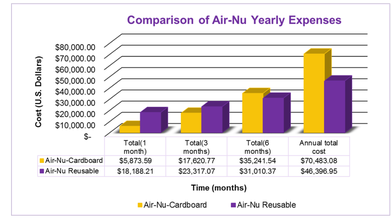
•Secure support rods with swaging tool

Testing

Test Types :

- •Dust Capacity
- •Weight
- •Surface Area
- •Final Resistance
- •Installation Time
- •Drop

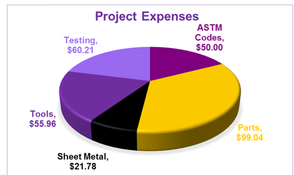
Cost Analysis



Total Savings = $ 24,086.13

Total Spent = $286.99

Total Budget = $3,000.00



September

- Preliminary Meetings
- Basic Concept Generation

October

- Begin Design Generation
- Develop Initial Models

November

- Finalize Analysis
- Develop Testing Outline
- Develop Manufacturing Plan

December

- Order Materials and Equipment

January

- Make Construction of Initial Model
- Begin Testing Initial Model

February

- Construct Second Iteration Model

March

- Analyze Results of Tests
- Finalization of Product

April

- Delivery of Final Product to Air-Nu

Sponsors: Robert Darbonne

Advisors: AJ McPhate, Clifford Gillio