To Predict ▶ To Design ▶ To Perform

College of Engineering
Department of Mechanical & Industrial Engineering

ME, ECE, BE Capstone Design Programs

Portable-Mobile Hoist: Team #34

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Sponsor: Tony Brouillette at Dow Chemical

Faculty Advisor: Dr. Warren Waggenspack

Alumni Advisor: Jonah Champagne

Background & Objective

Dow removes Pressure Safety Valves (PSVs) annually for servicing

- Current methods for removal: Use a large crane or erect scaffolding
- Costs Dow approximately $1,000 for crane rental, half a day's work for one operation, and 6-7 operators

Advantages over current method

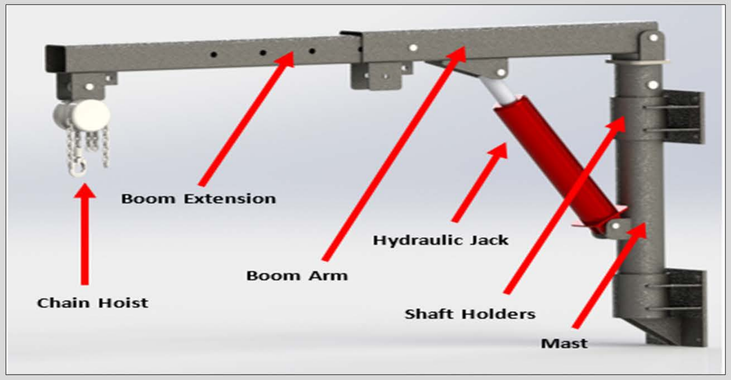
- Cost savings
- Time savings
- Decrease in potential safety hazards
- Decrease in man power

Objective: Design a safe and portable hoisting device for use within confined operational spaces of an industrial setting for the removal of PSV's

Engineering Specifications

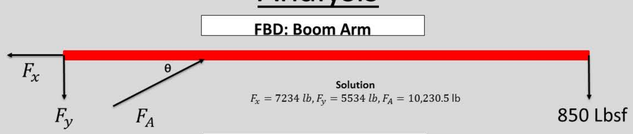
Description	Constraint
Weight of Each Subassembly	≤ 50 lbs
Total time Limit to Assemble, Operate, and Disassemble the Device	≤ 120 min
Maximum Vertical Range *(From Device to Valve)*	≥ 3 ft
Maximum Horizontal Range *(From Device to Valve)*	≥ 6 ft
Lifting Capacity	≥ 750 lbs
Factor of Safety	≥ 3:1 FOS to yield
Total Range of Rotation	≥ 180 Degrees of Rotation
Number of People for Operation	≤ 2

Prototype

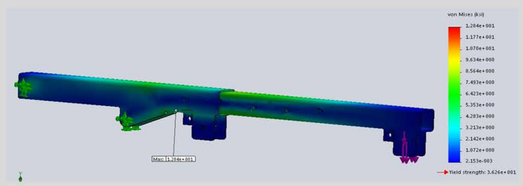


Analysis

FBD: Boom Arm



FEA: Boom Arm



Testing

Testing Results	
Load Test	125% rated load for 30 minutes (950 lbs)
Weight Verification Test	All components weighed under 50 lbs
Timed Operation Test	Average completion time: 13:59 minutes
Timed Assembly/Disassembly Test	Average completion time: 62:43 minutes
Deflection Test	Resulted deflection: 0.9 inches
Spatial Test	(i) 175° rotation of boom
	(ii) Maximum horizontal range: 6 ft
	(iii) Maximum vertical range: 3 ft

Pre-Load: 48 3/8"

Load (850lbs): 47 1/2"

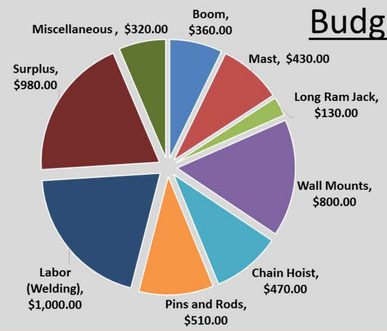
Deflection Test

Assembly Test

Operation Test

Spatial Test

Budget



Allowed Budget From Sponsor: $5,000

Total Price of Prototype: $4,020

Surplus: $980