Team # 27

Revitalizing Insulated Pipe Hanging Standards

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Mentors: Dr. Leach, Dr. Fred Berry

Customer Background

Team 27's Client, who wishes to remain anonymous, is a company located in Mishawaka Indiana. They specialize in the components used to hang insulated pipe, and they wish to do so in the cheapest and safest way possible, without risking the integrity of the surrounding material itself.

Problem Statement / Scope of Work

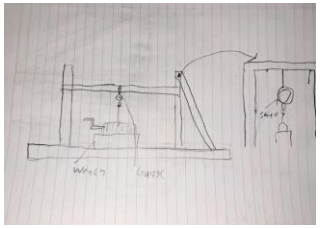
The Client tasked team 27 with creating a testing unit and FEA analysis to prove industry standards. This will give their cliental precise quotes confidence in the products.

Requirements

Req. #	DESIGN REQUIREMENTS	DESIGN TARGETS	VALIDATION
	RATIONAL		
1	create a testing unit for our client that is able to test sheets under 2 feet in length but accodate for longer round stock	The bar lengths will be cut to 18-20 inches in length and the workspace should be able to accomidate atleast 24 inches	cut bars to length as well as order a press with a hig enough workspace
	There is no premade unit for testing		
2	Be able to accurately measure pressure applied to the unit in terms of psi	have a guage that can measure up to 5000 psi and have 100 psi or less accoments for quality readings	Having accurate measurement for data collected
	Without proper data the client will not be able to convey to client as well pricing and strength of the system they are quoting		
3	Be able to test different round stock sizes from 0-12 inches in diameter	Be able to have anlog material sizes that covers the mass sizes our client covers	Our cliedat has a wide varity of material they support
	Round stock varrying from under 1/2 inch to over 12 inches in diameter will not be useful for testing		
4	have finite analysis of the model created in solidworks	Have provided material created and tested in solidworks	Having cad software analysis readouts
	The client specifically noted that he wanted a finite analaysis on hand for the different units tested		
5	be able to chart product failure points of the material noted in length, width, and psi	having an excel spreedsheet with failure points captured	An excel sheet that has set data in it as well as theoretical failure points
	The material come in multiple guages and lengths and there needs to be reasoning behind the selection for potential customers		
6	be able to chart product failure points of blocks noted in length, width, and psi	having an excel spreedsheet with failure points captured	An excel sheet that has set data in it as well as theoretical failure points
	The blocks come in 2 varies of wood and one foam composite that don't have know failure points		

- Working hydraulic testing press
- Realistic product failure in SolidWorks
- Failure charting
- Work withing budget

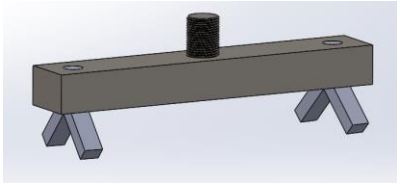
Experimentation and Concepts



Electric Winch Draft

Strengths:
- Similar to Clients Original Idea
- Repeatable
- No manual crank needed

Weaknesses:
- Requires Electricity
- Does not distribute force
- Hard to set up each test



Testing Head Mk I

Strengths:
- Cheap and Easy to Produce
- Distributes Weight Easily

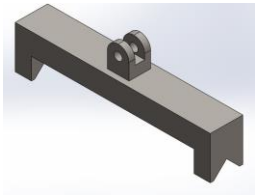
Cons:
- Cannot Withstand Forces Needed
- Not Durable

FMEA

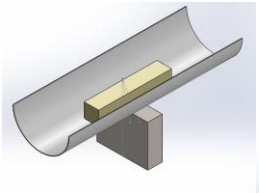
2. Focus Element	2. Focus Element Function and Requirement	1. Failure Effects (FE) to	Severity (S) of FE	2. Failure Mode (FM) of the Focus Element	3. Failure Cause (FC) of the Next Lower Element or Characteristic	Current Prevention Control (PC) of FC	Occurrence (O) of FC	Current Detection Controls (DC) of FC or FM	Detection (D) of DC	DFMEA Preventive Action	DFMEA Detection Action
H Frame Press	Sturdy Structure that wont break or buckle under the applied load.	It will render the press Inoperable	9	the frame can bend or break from the resulting force	the frame could bend from the forces that could cause th	Do not overstress the press	2	Visual Inspection	7	Do not overstress the press	Keep Eyes and ears open while operating the system
PSI Guage	Needs to measure the forces applied to sample	Will be unable to read the pressure therefore a the test results will be useless	8	The gauge will tack out	Too much pressure or a guage not built for certain pressures	Ensure that the Gauge we use is for a high enough PSI	3	Visual Inspection and careful operation	7	Won't overpressure the press	Keep Eyes and ears open while operating the system
Hydraulic Press Head	Needs to be able to withstand the forces during testing	test fixture will be Inoperable due to inability to properly direct force	9	Press Head breaks during a test	hydraulic press head is improperly machined and is not able to properly apply load to inhield	press head is machined according to current correct specification	2	Visual Inspection	7	Use a strong enough metal in the beam to ensure a safe load	Keep Eyes and ears open while operating the system
Pipe Simulator (Round Stock)	Pipe Simulator must be properly adjusted and aligned to ensure simulation of applied system	testing results are likely to be incorrect	6	Round Stock is improperly adjusted or misaligned	User end, improper setup during testing process	Inspect roundstock prior to use in testing process	2	Visual Inspection	7	Make sure it is properly alligned before each use	Keep Eyes and ears open while operating the system

Final Design

Completed Hydraulic Press

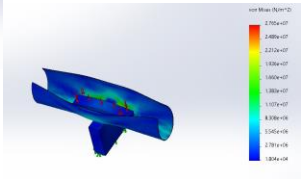


Testing Head



Part Assembly

Load Cell



SolidWorks Simulation

Testing

Deformed sheet

Testing load cell