

Problem Statement:

A glove box is required to protect people from the potentially harmful conditions that could arise from the testing of certain alloy such as INL's current project using U-Pu-Zr alloys. Most High Strength Tensile Testing Systems with heaters are too large to fit into a glovebox needed for the alloys.

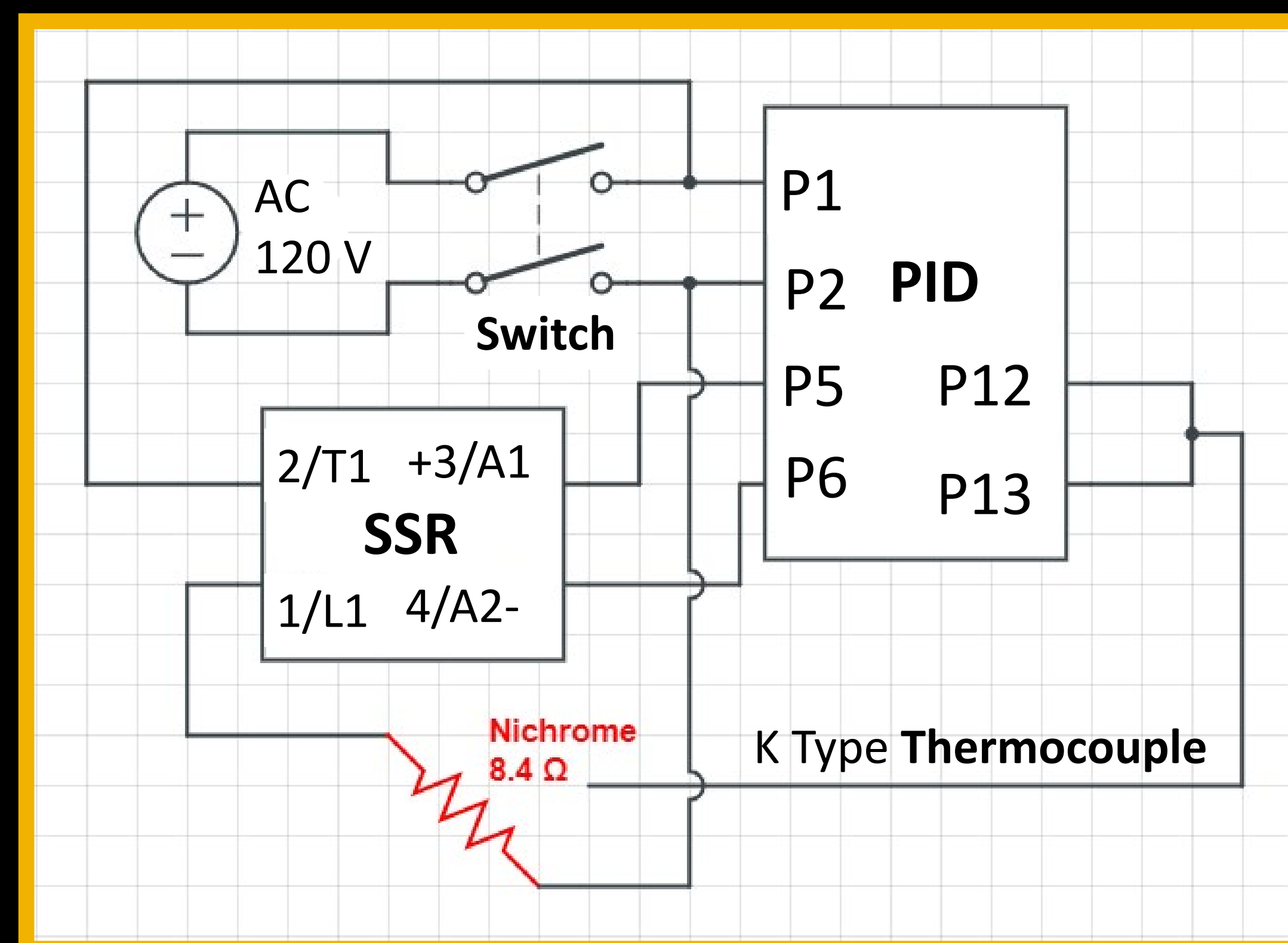
Value Proposition

The goal is to create an easy to assembled small-scale tensile testing system for an existing glovebox, fitting through an 8-inch hole and be easily assembled once inside.

Key Requirements

- Must be able to complete a tensile test and gather data
- Must be able to run a test at 700°C.
- Must fit through an 8-inch glove hole
- Must be easy to assemble with gloves on

PID Instrumentation Design:



- **Power Supply:** AC 120 V
- **Emergency Stop Switch:** User shuts off entire system in case of PID run off.
- **PID:** Proportional Integral Derivative Controller – User interface to control and monitor nichrome wire temperature.
- **SSR:** Solid State Relay – on or off switch supplying external voltage to nichrome wire.

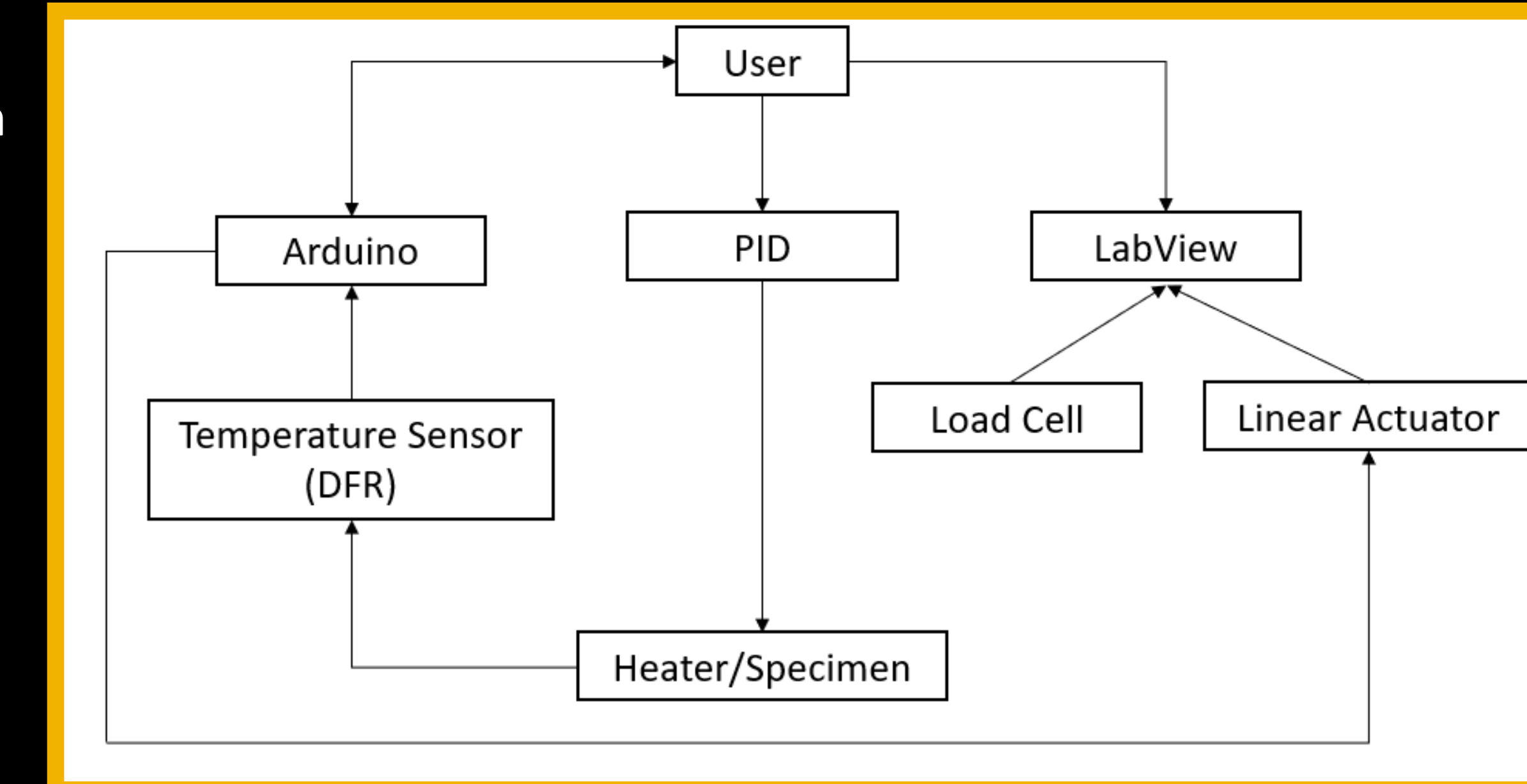
System Design:



Frame:

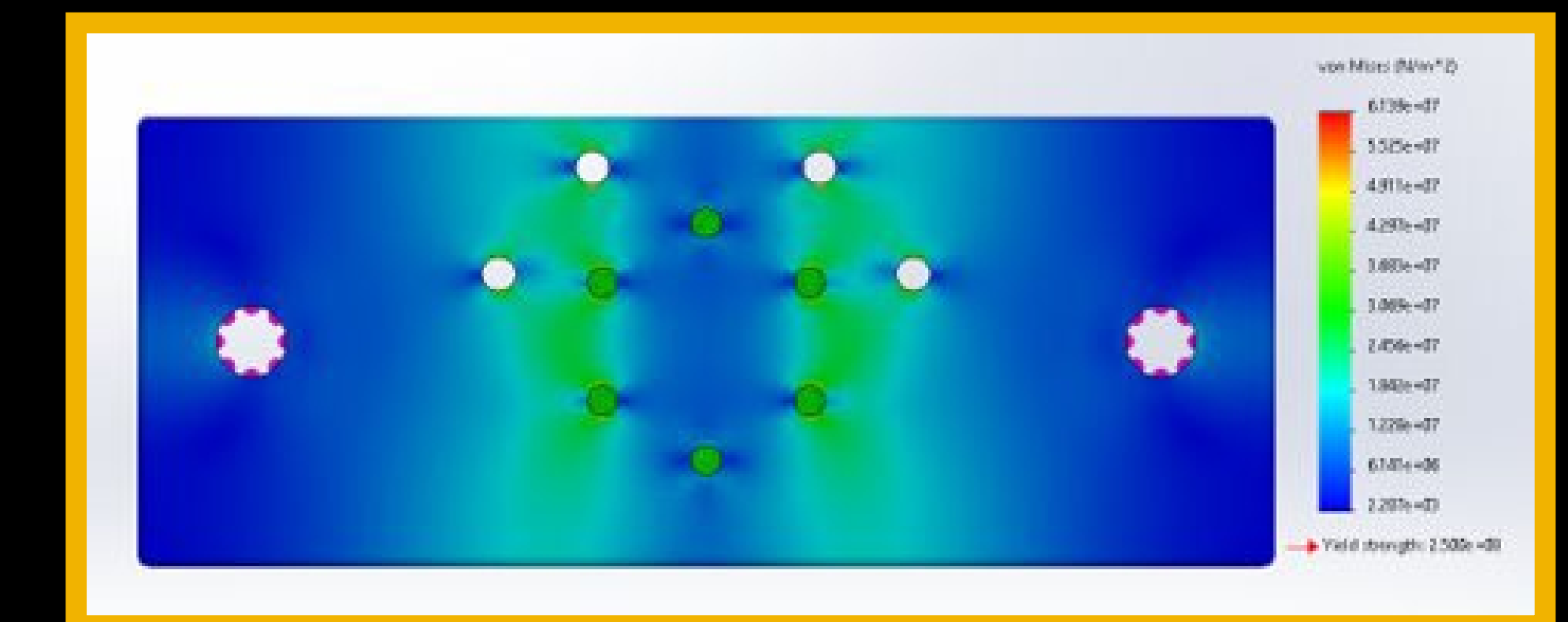
- **Top Plate:** Holds the linear actuator as well as supporting guide rods.
 - **Linear Actuator:** Providing a maximum 1500 [lbf] with a safe operating limit.
 - **Guide Rods:** Creates the path for the linear actuator to provide tension.
 - **Cross Head:** Connects linear actuator to grips.
 - **Bearings:** reduces the friction between the cross head and guide rods.
 - **Grips:** Supports specimen connect to cross guard and load cell.
 - **Load Cell:** Measures the force on specimen.
 - **Base Plate:** Supports entire frame.
- Heater:
- **Shell:** Retains heat from heater and provides safety to user.
 - **Refractory Bricks:** Main insulator to heat specimen.
 - **Support Legs:** Supports static heater shell.
 - **Nichrome Wire:** Heats the specimen and heater air to a max of 800°C.

User Interface:



- This diagram shows how the user will interface with the instrumentation which is housed by a control box and connected to the system and a computer.

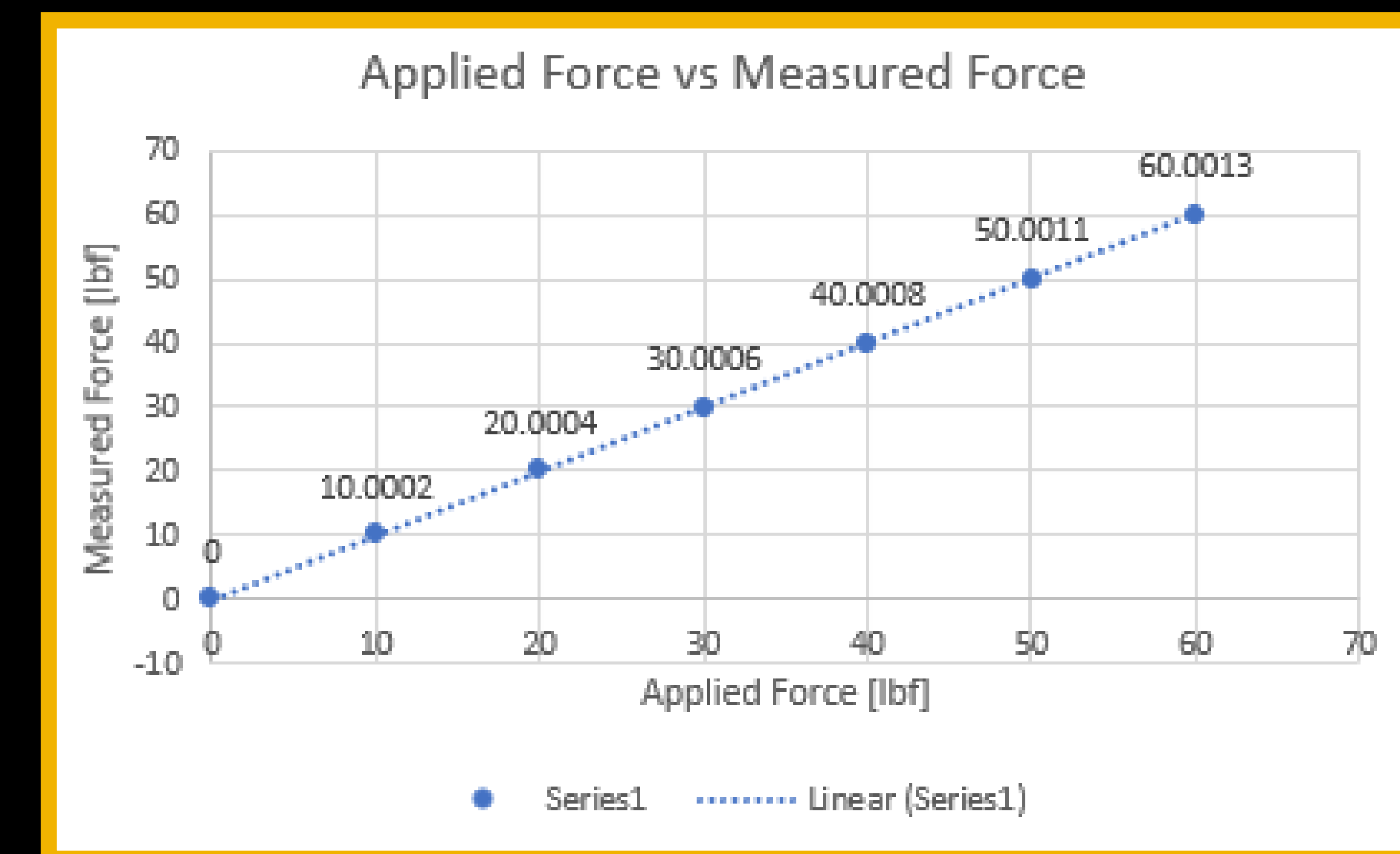
Base Plate Stress Analysis:



Load Cell Validation Values:

Weight (lbf)	Reading (mV)	Load Measured
0	0.41107	0
10	0.4264	10.0002
20	0.436621	20.0004
30	0.446841	30.0006
40	0.467062	40.0008
50	0.467282	50.0011
60	0.477503	60.0013

Load Cell Validation Graph:



Manufactured Frame:



Acknowledgements

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