Team 2 – Biaxial Stress/Strain Fixture

Products

Plans/Specs

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Introduction

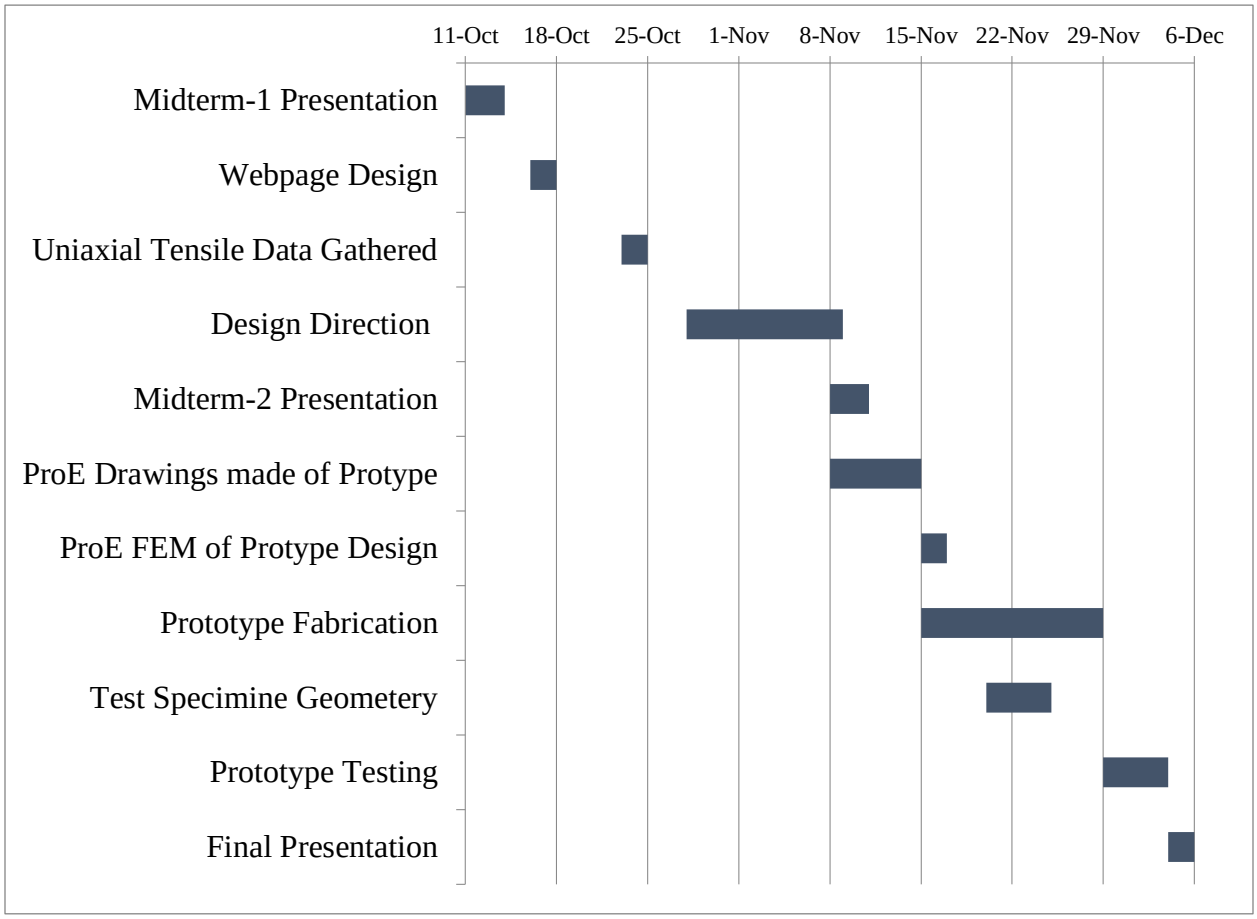
Compression data is difficult to gather for gasket material due to the other stress states that appear while testing. When a biaxial tensile load is applied the resulting state is compression. The purpose of this project is to build a biaxial tensile test fixture that can be used with existing MTS machines without any modifications. The final design will be used for the quantity control testing of gaskets during production.

Objectives

The objective of this product is to design and produce a mechanical device capable of transforming a uniaxial tensile tester into a biaxial tension tester for gasket materials. This device must:

- Perform uniaxial motion that is directly proportional between the perpendicular axis of the MTS machine and the device.
- Be capable of being used in an MTS machine without making alterations to the machine.
- Be simple enough to be installed, removed and used by any technician.
- Be constructed from materials that are readily available and of a low enough cost so that the device will be commercially viable.
- Be tested rigorously to ensure that it is durable over hundreds if not thousands of cycles without the need for maintenance.

Gantt Chart



Designation of Labor

Ben Hainsey (Team Leader)

Manages the entire team. Organizes meetings between the team and also with the sponsor and faculty adviser. Oversees all decisions of the group. Helps settle any disputes.

Eric Hebner (Financial Advisor)

Manages the budget and maintains a record of all credits and debits to project account. Any product or expenditure requests must be presented to the sponsor, whom is then responsible for reviewing and the analysis of equivalent/alternate solutions. They then

relay the information to the team and if the request is granted, order the selection. A record of these analyses and budget adjustments must be kept.

Nicole Walsh (Web Designer)

Responsible for designing and maintaining the web page for the group. Will upload all deliverables to the web page to be viewed by anyone interested.

Product Specifications

Design Specifications

- The device must fit within an MTS machine with a maximum clearance of 24”
- The maximum distance that the device must stretch a sample will occur with the rubber gaskets.
    - Maximum elongation percentage at failure will be around 850%. We will not be required to elongate to failure.
    - Rubber materials are nearly uniform, and therefore do not require a large cross-sectional area to provide accurate data. Therefore, a sample width of 1.5” will be more than sufficient.
    - A total stretch of 15” will allow the device to elongate all common rubber gaskets beyond failure.
- The maximum forces will also be exerted on the device by the rubber gaskets. Given a maximum tensile strength of 8,000 psi and a cross-sectional area of 1.5” a maximum assumed force of 17,000 psi will provide a sufficient margin of safety.
- The grips which hold the specimens have several requirements themselves.
    - They must securely hold a 1-3mm thick, 1.5” wide strip of rubber without slippage or excessive pinching so as to provide an even pull that will not compromise the structure of the rubber.
    - The grips must also hold a 0.25-2mm thick, 4” wide fiber gasket in a manner that will not compromise the gaskets structure.

        - The greater width of the fiber gasket is due to the irregularities in its structure which will require a larger cross-sectional area to minimize errors due to those irregularities.
        - The larger width will also provide the opportunity to analyze how much these irregularities can impact the strength of the gasket.
    - Due to the large differences in gripping methods, two interchangeable grips will likely need to be developed.

Performance Specifications

- This device must be easily installed in an MTS machine without altering the machine in any way.
- No special tools should be required in order to install the device or change any components which may be interchangeable such as grips and machine attachments.
- The device must be able to be installed and operated by a technician with minimal training required.
- The motion of the device must be smooth and equal in each direction of pull in order to produce meaningful data.
- The device should provide an unobstructed view of test samples to allow for visual video analysis of the sample.
- The structure of the device must be so that it creates no shear forces or bending moments within the sample.

Summary

This project is very much still in the preliminary design stage. Much testing needs to be done on the gasket materials provided to us. This will help solidify the performance and design specifications. Testing will be done very shortly and designs will then begin to be developed and analyzed.