Tensile Testing Lab

The purpose of this laboratory is to empirically determine the tensile strength of the material used for your truss members. Each group will test one or two tempered hardboard sample strips. The general shape of the specimen is shown in Figure 1 – this shape is often referred to as a "dogbone." This lab will require each student to evaluate both normal (tensile) failure and tearout failure. The dogbone specimens have similar dimensions at the ends (as shown in Figure 1), but may not have the same cross sectional area in the narrowed gage area at the center; therefore, you will need to carefully measure the dimensions of the smallest section of your sample.

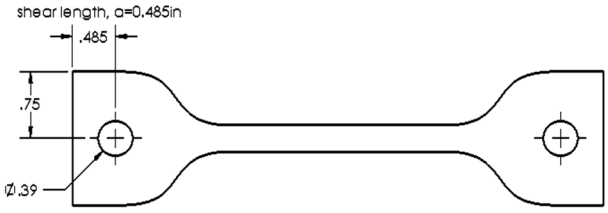

Figure 1. General shape of the tensile test specimen along with some key dimensions.

Each specimen will be clamped into the Tinius Olsen testing machine. A picture of the testing machine can be seen in Figure 3. The main power and emergency shut-off switch can be seen in Figure 2. If turning on the machine by the main power switch does not seem to work, try rotating the e-stop button as indicated by the arrows. To quickly shut down the machine in the event of an emergency push the e-stop switch down. Figure 4 shows a close up of the control panel for the Tinius Olsen.

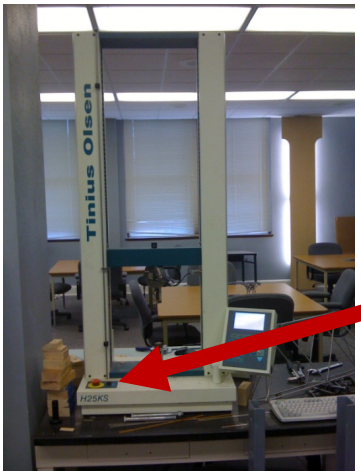

Figure 4. Tinius Olsen testing machine.

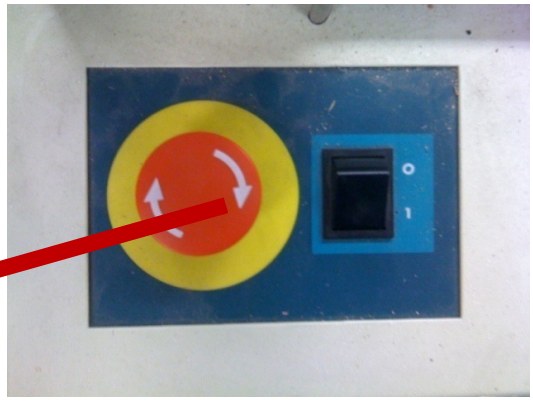

Figure 2. E-Stop and main power switch.

Figure 3. Control Panel

You will use the panel shown in Figure 4 to control the operation of the machine. This panel will also display the force measured by the machine's load cell. The panel has an LED that indicates if the machine is in jog mode or in continuous movement mode. If the LED is flashing, the machine is in jog mode where pushing the up or down arrows will move the crosshead at a fast rate (20 in/min). While in jog mode, the crosshead will only move while the arrows are held down. A solid LED indicates the machine is in continuous mode. In this mode, the crosshead will move at a slow speed (1 in/min), but will continue to move until the stop (circle) button is pressed. To switch between the modes, press the stop button (the center button with a yellow outline and a white circle). In order to perform your test follow the instructions shown below.

Test Procedure

1. Secure the specimen in the testing fixtures – use jog mode to position the crosshead.
2. Switch to continuous mode by pressing the circle button -solid LED.
3. Zero the force by pressing the F1 button – it may not read exactly 0 lbf.
4. Check to be sure the display indicates that "Peak Hold" is on.
5. Press and release the "up" button to begin moving the crosshead up.
6. Press the stop (circle) button once the specimen has fractured.
7. Record the maximum "peak" force applied to the sample.

A homework assignment must be completed for this lab. You will need to utilize all of the data collected in our class. Complete the following activities.

1. Write a paragraph about the setup of the experiment. Things you will want to mention include:
   a. A description of the equipment
   b. A description of the data you were seeking and how it was obtained
   c. Your own diagram showing the shape and the important dimensions of the specimens. (Note: not all important dimensions are provided in the image.)
2. Create a table listing the data collected in class and group the data based on failure type (tensile failure or tearout). Be sure to use proper formatting for the table. (Units in column headings, borders that make reading the table easier, appropriate significant figures, etc.)
3. Calculate the ultimate normal stresses for each tensile failure specimen and the ultimate shear stresses for each tearout specimen and show these in a table. These values may be included in the table from (2.) above. Be sure to show an example of how you calculated these values.
4. For each failure type, create a plot of ultimate load versus cross-sectional area. Note the shape of the curve generated and comment on what it means. Be sure to use proper formatting techniques on these plots (labeling axes, including units, including a title, etc.)
5. Calculate the mean and standard deviation of the ultimate stress values for each failure type computed above.
6. Create a histogram illustrating the distribution of ultimate stress values for each failure type. For help in creating a histogram see:

   http://www2.latech.edu/~dehall/LWTL/home/sophomore/engr220/histogram/histogram_steps.html

   Excel has a built-in function called FREQUENCY that is useful for creating histograms. Look in Excel help if you are interested in using this function to help you create your histograms.
7. Write a descriptive, concluding paragraph about what you have learned or proven by performing this lab. Remark on possible implications for the end-of-course truss design project.

Note: You may complete this assignment with each part numbered 1-7 similar to a normal homework assignment. Be sure to format all parts of the assignment correctly (particularly tables and graphs). Do not place the assignment in a folder, instead, staple it at the upper left corner, fold it lengthwise and put your name and "Lab 1" on the outside like a normal homework assignment.

This assignment must be completed INDIVIDUALLY (not in groups). You must create your own tables, make your own plots, and do your own analysis and writing. No sharing of information is permitted.