ASEN 3112 LAB 1: MTS Torsion Testing

ASEN 3112: Structures
University of Colorado at Boulder

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1 Machine Operation Rules

- Only students who have been shown how to use the machine by ASEN staff, ASEN instructors, or a qualified TA may operate the Torsion Test Machine. TA or course assistant supervision is required during group tests.
- Be cautious of yourself and your group members when operating the machine. The MTS machine is capable of extremely high hydraulic forces and can be dangerous.
- Safety glasses are required at all times during machine operation.
- There are 3 Emergency Stop Buttons on the MTS Machine. The first is located on the MTS Machine, the second is on the MTS Hydraulic Pump, and the third is a movable button near the computer.

Figure 1: MTS 809 Axial/Torsional Test System.

2 Data Recorded

The variables recorded in the output data file are the following:

1. Column 1 is Time.
2. Column 2 is shear strain, γ, as measured by the extensometer. The units are degrees. It represents the average strain over the instrument's gauge length ($L_{\text{ext}} = 1$ inch).

3. Column 3 is the total twist angle applied to the specimen, in degrees. It is recorded by an encoder in the grip. In order to convert it into strain, you will need to specimen the total length of your specimen, *i.e.* the distance between grips.

4. Column 4 is the applied torque, T, in in-lb.

The analysis required is described in the *Lab 1 Description* file. Geometric values can be found there too. The only measurement that you will need to perform during the test is the length between the grips, once the specimen is loaded, in order to calculate average strains from the total twist angle.

3 Experimental Procedure

3.1 Torsion Testing Program Start

1. Ensure *Multipurpose Elite* and *Station Manager* are open.

2. Ensure *Multipurpose Elite* is showing "1000N-m Torque Cell_episilon.cfg" at the top of the program window. This is to ensure that the program is using the correct load cell and sensor package.

3. Open the "ASEN3112_400in-lb-return"(CTW Specimen Program) or "ASEN3112_20in-lb-return"(OTW Specimen Program). Proceed to $file \rightarrow opentest \rightarrow Desktop \rightarrow ASEN3112 \rightarrow Lab1(Torsion) \rightarrow ASEN3112\_\#in-lb-return$.

4. Ensure the correct file has been chosen for the specimen being tested. *Note: Using the wrong file on either specimen may destroy the sample.*

5. Click "New Test Run" Icon in top left of program.

6. Click "OK" twice and the test display will appear.

7. Acknowledge the Specimen Type Procedure window matches your testing specimen, click Run, and click Close.

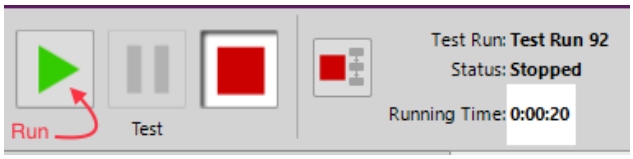

Figure 2: Run Button in *Multipurpose Elite*.

8. Ensure that the test section is empty and confirm this by clicking the top left Operator Action "Confirm Test Section Empty". Before clicking this ensure no one is near the bottom grip as it will automatically move to its starting location.

3.2 Specimen Installation

1. Follow the Specimen Installation Procedure shown in the figure below.

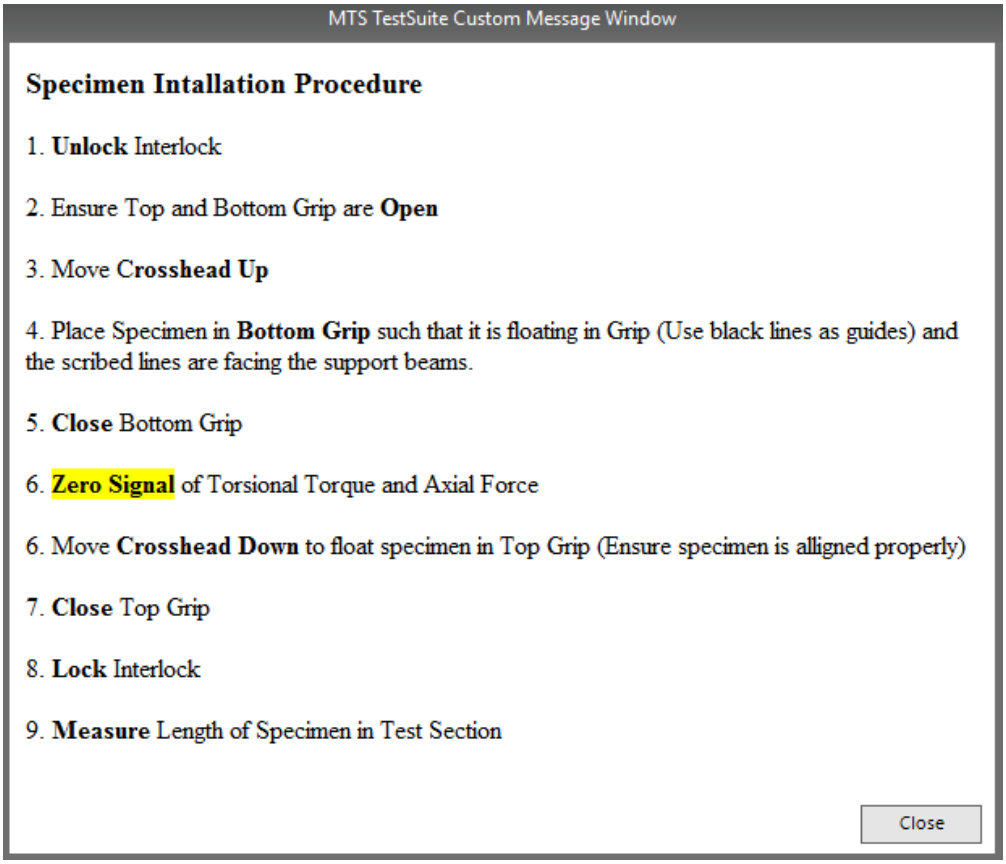

Figure 3: Specimen Installation Procedure.

2. Click close and click the Operator Action Button "Confirm Specimen Installation".

3.3 Extensometer Installation

1. Follow the Extensometer Installation Procedure shown in the figure below. Note: There are precise grip points on the Extensometer, labeled in the figures below.

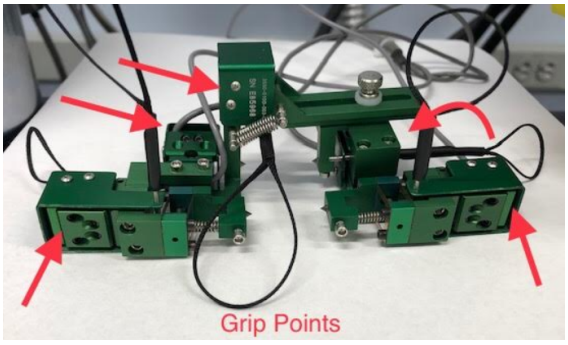

Figure 4: Extensometer Grip Poimts

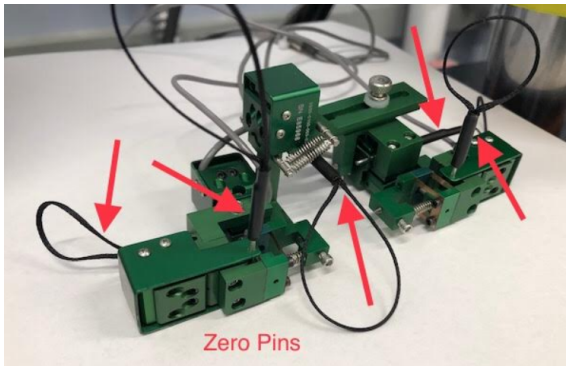

Figure 5: Zero Pin Locations

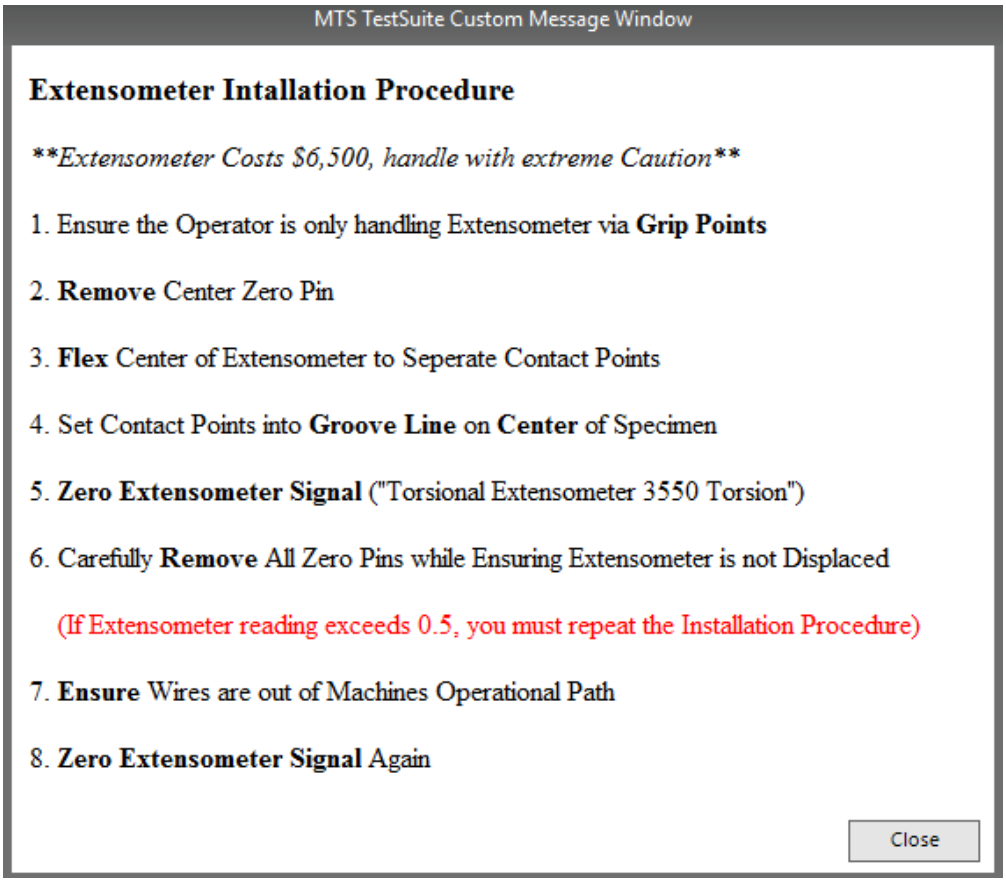

Figure 6: Extensometer Installation Procedure.

2. Click close and click the Operator Action Button "Confirm Extensometer Installation".

3.4 Enclosure Installation

1. Follow the Enclosure Installation Procedure shown in the figure below.

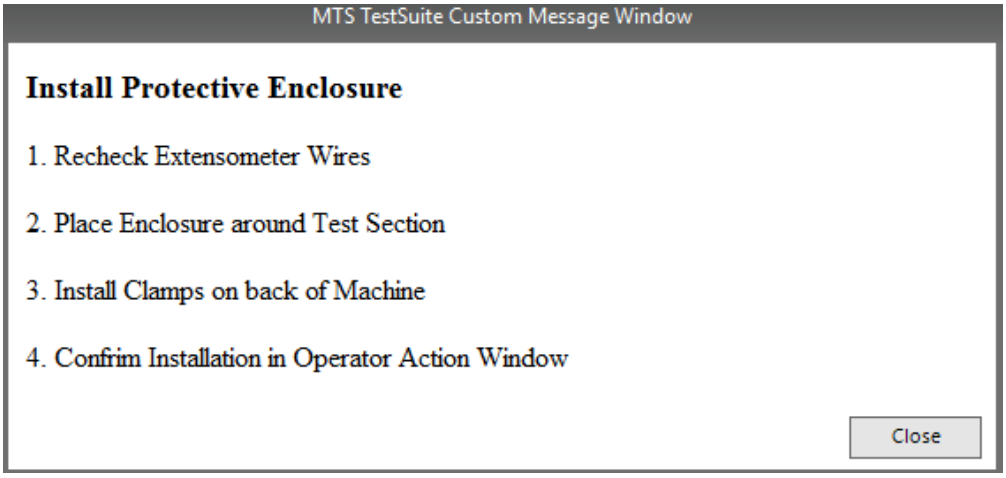

Figure 7: Enclosure Installation Procedure.

2. Click close and click the Operator Action Button "Confirm Protective Enclosure Installation".

3.5 Torsion Applied to Specimen

1. Follow the Reset Station Manager Procedure shown in the figure below.

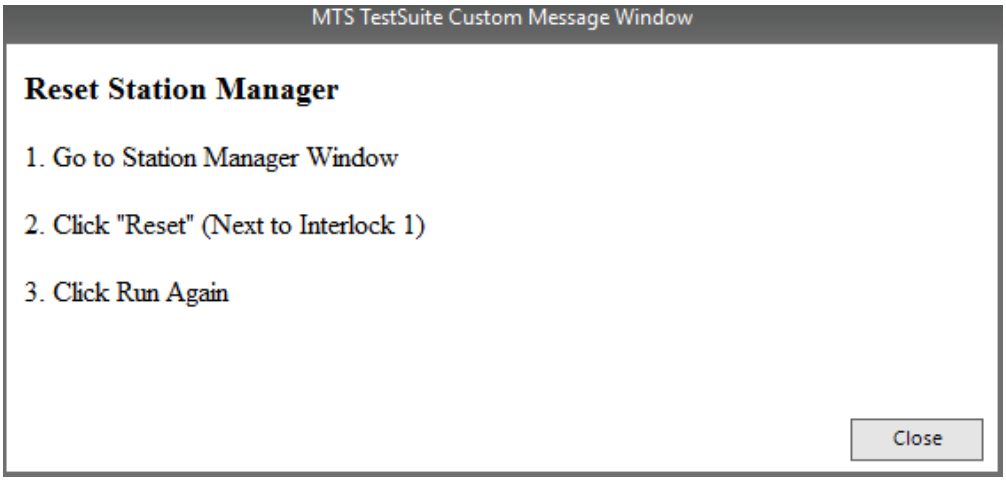

Figure 8: Station Manager Reset Procedure.

2. Click close and click the Operator Action Button "START TEST".
3. Wait for the program to execute the ramp up and down process.
4. Click Operator Action Button "Confirm Test Complete" to continue.

3.6 Enclosure Removal

1. Follow the Enclosure Removal Procedure shown in the figure below.

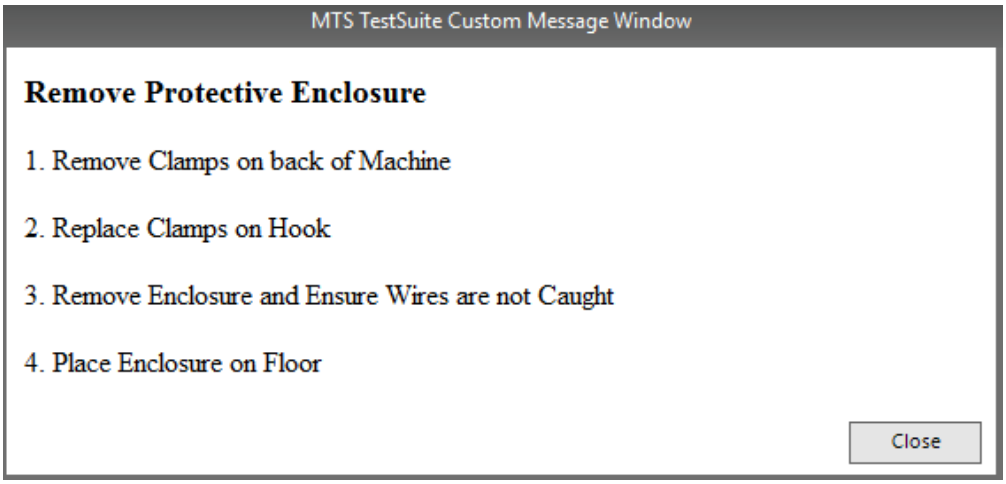

Figure 9: Enclosure Removal Procedure.

2. Click close and click the Operator Action Button "Confirm Protetive Enclosure Removal".

3.7 Extensometer Removal

1. Follow the Extensometer Removal Procedure shown in the figure below.

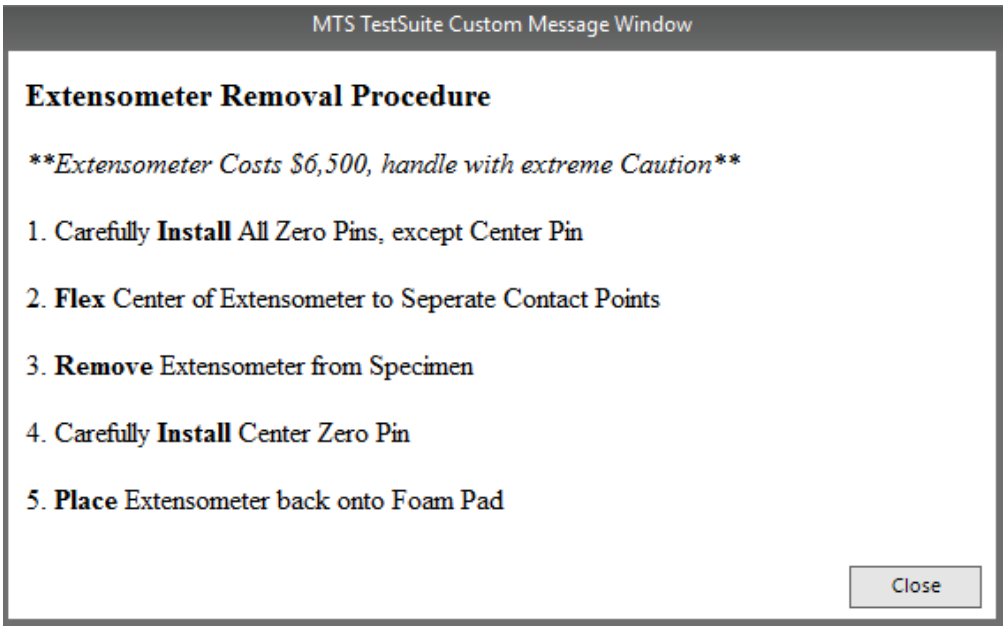

Figure 10: Extensometer Removal Procedure.

2. Click close and click the Operator Action Button "Confirm Removal Installation".

3.8 Specimen Removal

1. Follow the Specimen Removal Procedure shown in the figure below.

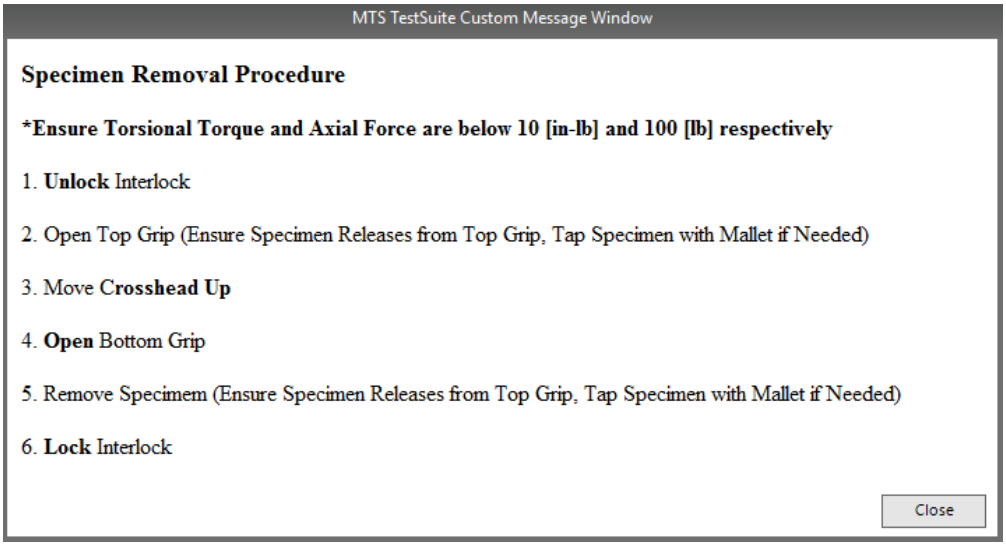

Figure 11: Specimen Removal Procedure.

2. Click close and click the Operator Action Button "Confirm Removal Installation".

3.9 Export of Testing Data

1. The Program should now return the operator to the navigation screen.
2. Navigate to the "Explorer" Column on the left side of the screen and scroll to the bottom to find the most recent test number. Remember this test number for exporting the data.
3. Navigate to the Export Raw Data screen via $File \rightarrow Export \rightarrow RawData$.
4. Click the "-" in the top right of the window to remove the current test number. Click the "+" to navigate to a new window to add the most recent data set. Scroll to the bottom of the left column and double click on the test number found earlier. Click "OK".
5. Click "Export".
6. Navigate to where the data has been saved via the file explorer following: $Desktop \rightarrow ASEN3112 \rightarrow Lab1(Torsion) \rightarrow Data$.
7. Review the data to ensure it looks accurate and recorded correctly. Also check if the Test Number matches at the top of the data file.
8. Add this data to a flash drive and move it to a personal storage device for later analysis.

3.10 Final Checklist

- ✓ Place Specimen in designated location (where it was found) for the next group.
- ✓ Remove tape and plugs from specimen.
- ✓ Ensure Extensometer is in a safe location.
- ✓ Return Safety Glasses if they were borrowed.
- ✓ Ensure data has been saved to personal storage devices.
- ✓ DO NOT close the MTS software.