Purpose: To find the torsional constant of the RG Swing for calibration.

Materials:

- Calibration cylinder with known mass and moments of inertia
- "RG Calibration Workbook"
- RG Swing to be calibrated with timing mechanism and electric eye counter

Procedure:

1. Open the "RG Calibration Workbook."

2. Change the custom header in the "Cal. 1" sheet to include the name of the first operator to run the calibration procedure, date and location of the RG Swing to be calibrated.

3. Run the calibration procedure below in parts a.-c.

    a. Determine the Period of the Empty RG Swing Cradle (T_c).

        i. Supply power to the timing mechanism and electric eye counter. Wait for timing mechanism to stop flashing so it has a constant display.

        ii. Set the RG swing in motion by rotating the cradle approximately 15 degrees counter-clockwise on a horizontal plane.

        iii. Push the "R" button on the timing mechanism so the electric eye counter display is "0" before the swing passes the sensor.

        iv. Once the electric eye counter reaches 11 (5 oscillations of the empty RG Swing cradle), the timer will stop. Record this time on the "RG Calibration Workbook" under the heading, "Period of Empty RG Swing Cradle."

        v. Without stopping the RG Swing from oscillating push the "R" button on the timing mechanism once the RG Swing cradle is on the same side of the electric eye counter that it was started in motion in Step ii.

        vi. Repeat Step iv.

        vii. Add the times recorded on the "RG Calibration Workbook" for the empty RG Swing cradle. Divide the resulting total by 10 yielding T_c for the RG Swing with empty cradle.

b. Determine the Period (T_1) and Torsional Constant (K_1) of the RG Swing with the Calibration Cylinder Vertical in the RG Swing Cradle.

   i. Place the calibration cylinder in the vertical position into the RG Swing cradle.

   ii. Set the RG swing in motion by rotating the cradle approximately 15 degrees counter-clockwise on a horizontal plane.

   iii. Push the "R" button on the timing mechanism so the electric eye counter display is "0" before the swing passes the sensor.

   iv. Once the electric eye counter reaches 11 (5 oscillations of the empty RG Swing cradle), the timer will stop. Record this time on the "RG Calibration Workbook" under the heading, "Period of RG Swing Using Vertical Cylinder."

   v. Without stopping the RG Swing from oscillating push the "R" button on the timing mechanism once the RG Swing cradle is on the same side of the electric eye counter that it was started in motion in Step ii.

   vi. Repeat Step iv.

   vii. Add the times recorded on the "RG Calibration Workbook" for the cylinder in the vertical position. Divide the resulting total by 10 Yielding T_1 for the RG Swing with the cylinder in the vertical position.

   viii. Using the following equation, in the "RG Calibration Workbook", determine the torsional constant (K_1) for the RG Swing with the cylinder in the vertical position.

$$K_1 = \frac{4 \cdot \pi^2 \cdot I_1}{T_1^2 - T_c^2}$$

Where I_1 is the moment of inertia calculated for the vertical cylinder (This should be noted on the calibration cylinder).

c. Determine the Period (T_2) and Torsional Constant (K_2) of the RG Swing with the Calibration Cylinder Horizontal in the RG Swing.

   i. Place the calibration cylinder in the horizontal position into the RG Swing cradle. Align the center mark on the cylinder with the notches in the RG Swing Cradle.

   ii. Set the RG swing in motion by rotating the cradle approximately 15 degrees counter-clockwise on a horizontal plane.

   iii. Push the "R" button on the timing mechanism so the electric eye counter display is "0" before the swing passes the sensor.

   iv. Once the electric eye counter reaches 11 (5 oscillations of the empty RG Swing cradle), the timer will stop. Record this time on the "RG Calibration Workbook" under the heading, "Period of RG Swing Using Horizontal Cylinder."

   v. Without stopping the RG Swing from oscillating, push the "R" button on the timing mechanism once the RG Swing cradle is on the same side of the electric eye counter that it was when it started in motion in step ii.

   vi. Repeat step iv.

   vii. Add the times recorded on the "RG Calibration Workbook" for the cylinder in the horizontal position. Divide the resulting total by 10 yielding T_2 for the RG swing with the cylinder in the horizontal position.

   viii. Using the following equation in the "RG Calibration Workbook", determine the torsional constant (K_2) for the RG Swing with the cylinder in the horizontal position.

$$K_2 = \frac{4 \cdot \pi^2 \cdot I_2}{T_2^2 - T_c^2}$$

Where I_2 is the moment of inertia calculated for the horizontal cylinder (This should be noted on the calibration cylinder).

4. Repeat Steps 2-3 for the second operator to run the RG calibration procedure using the "Cal. 2" sheet in the workbook.

5. Print the "RG Calibration Workbook" (It should include sheets "Cal. 1," "Cal. 2," and "Summary."

6. Keep the "RG Calibration Workbook" near the RG Swing that was calibrated.

7. Enter the Overall Torsional Constant (K) and Moment of Inertia of the RG Swing Cradle (I_c) from the "Summary" sheet into the "RG Calculation Worksheet" for the particular RG Swing calibrated.