Standard Operating Procedure: SOP-BALL-9

Coefficient of Kinetic Friction of a Bowling Ball

Rev	Date	Staff Member	Purpose
5	12/19/19	A. Stanton	Minor Process Update
4	11/13/19	A. Stanton	Add calibration/verification procedure
3	05/17/11	J. Milligan	Changed CG alignment in step 4
2	12/13/10	N. Mours	Process update
1	02/18/09	D. Benner	Rewrite for clarification
Origination date: 10/30/07		Originator: T. Robben	

Purpose: To determine the kinetic coefficient of friction of a bowling ball.

Materials:
- Bowling ball to be tested
- Bowling ball sled that prevents the ball from rolling
- Standard lane surface sample, measuring at least 24 inches by 36 inches.
- Computer that has the WinDaq700USBO recording software and WWB analysis software.
- Electric motor assembly that will pull the bowling ball sled
- Force transducer
- "COF Worksheet" Excel file
- Microfiber towel

Procedure:

1. Unwind the belt containing the force transducer from around the wheel on the motor assembly and extend the sled so the length of the belt is lying straight across the standard lane sample.

2. Remove the force transducer from the ball sled and the motor assembly and set it on the lane sample so there is no force being applied to either end.

3. Press the "Tare" button on the display for the force transducer so the display reads zero.

4. Re-connect the force transducer to the ball sled and to the motor assembly.

5. Clean the lane surface sample thoroughly with isopropyl alcohol and a microfiber towel. Allow the lane sample to dry completely.

6. Place the bowling ball in the sled with CG marking of the bowling ball aligned along the front edge of the sled in line with the eye bolt. Ensure that the area of the bowling ball in contact with the lane sample is clear of any markings used for identification of the ball.

7. Place one .005" shim under each of the rear wheels of the sled and tighten the T-Handle to secure the ball in the sled.

8. On the COF computer desktop, select the "Shortcut to HardwareManager.exe" program.

9. In this DATAQ Hardware Manager screen, wait for "5293BDFD" to come up, then select "Start Windaq".

10. Select the File > Record.

11. Select the folder in the (P:) drive titled "COF Ball (year)" for the current year.

12. Create a file name using the following naming convention ['Ball Name' 'last 4 of Serial Number']

13. Select "Open" and select "OK".

14. Flip the switch beside the motor to energize the motor.

15. De-energize the motor once the ball has been pulled across the standard lane sample and just before the belt would wrap around the wheel of the motor assembly.

16. Unwind the belt from around the wheel on the motor assembly and extend the sled so the length of the belt is lying straight across the standard lane sample, still connected to the bowling ball sled, but not taught.

17. Repeat Steps 14-16 for a total of eight measurements recorded by the computer.

18. Select File > "Close". The data for this ball has been saved.

19. To read the data, access the "COF (year)" folder on the (P:) drive and look for the ball you need and double click to bring up the graphs.

20. The zero-baseline reading can be seen at the beginning of the recording where no force was being applied. Examine each of the eight peaks and using the grid on the screen and the zero-baseline reading. Each of the 8 runs will have a peak followed by a plateau. Record the median value from each of the eight individual plateaus into the test sheet for that ball.

21. The average COF and the standard deviation of the COF are automatically calculated withing the ball test sheet.

22. Close the WWB program windows with the graphs and select "Exit with no Save".

If ball results indicate the CoF is out of spec:

1. Test that the load cell is operating correctly.

2. Remove load cell from the friction ball sled and secure the end attached to the motor to the table with a clamp as shown in the picture below. Hang a known **5 Lb.** weight from the hook on the other end and record the value from the digital display.
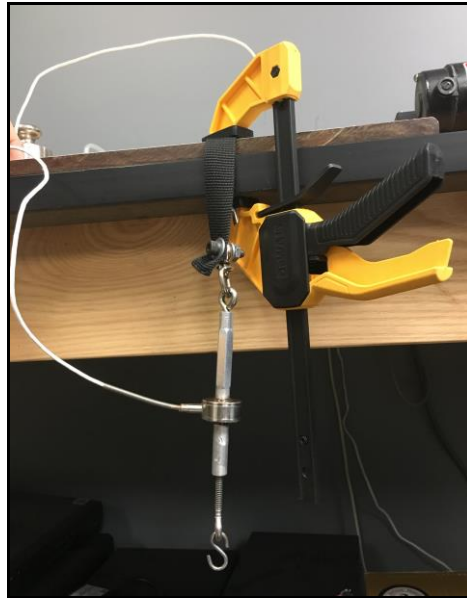
3. If tested values are within ±0.005 of the expected values, the load cell is operating correctly.

4. If tested values are not within ±0.005 of the expected values, schedule an appointment with Mettler Toledo for professional calibration.

Calibration

The load cell is to be professionally calibrated every 6 months (July/December) with Mettler Toledo.

If any test ball presents values outside of the friction specification, the load cell used must be verified. Please see previous section.