Standard Operating Procedure: SOP-BALL-10

Surface Roughness of a Bowling Ball

Rev	Date	Staff Member	Purpose
8	12/6/19	J. Milligan	Add other sanding method
7	11/13/19	A. Stanton	Added calibration/verification procedure
6	1/22/14	E. Troutman	Clarifying process
5	12/14/10	N. Mours	Generalization of procedure
4	11/16/10	C. Bushnell	Sanding Time and Mode Select
3	8/18/10	C. Bushnell	Number of Locations
2	06/30/09	N. Mours	Process and file saving
1	02/17/09	N. Mours	number of samples & process
Origination date: 10/30/07		Originator: N. Mours	

Purpose: To determine the surface roughness of a bowling ball.

Materials and test conditions:
- Abralon pad of desired grit
- Ball cup
- Bowling Ball
  - Ball surface preparation – Ball Surface is to be prepared as described in Ball-SOP-18 Surface Preparation.

- Burette clamp
- Microfiber towel
- Isopropyl Alcohol
- Level work surface
- Right angle clamp
- Small level
- Surface Preparation Machine
  - Surface Factory
  - Sure Spin (with USBC control box)
- Mitutoyo SJ-301 Surface Roughness Tester (Profilometer)
- Precision surface roughness specimen
- Triangular base stand
- Disposable laboratory gloves
- Mitutoyo SJ-301 Surface Roughness Tester Quick-Reference manual
- Surface Roughness 15 Spot Template, Excel file

Note: Vibrations and non level work surfaces can cause errors in readings. Please take care to make sure that the work surface is level and there are no fans, motors or other vibrations around the work surface (bumping into the work surface, typing on a keyboard, telephone, or opening and closing drawers can cause inaccurate readings).

Procedure:
1. Assemble the Mitutoyo SJ-301 Surface Roughness Tester.

   a. Supply power to the display unit by connecting the AC adaptor to an electrical outlet and the display unit.
   b. Connect the detector and the drive unit. Do not touch the stylus on the detector.
   c. Connect the drive unit to the display unit via the cable provided.
   d. Energize the profilometer by pushing the button labeled "POWER" located on the right end of the display unit.

e. Add the support foot to the end of the drive unit with the cord by sliding it upwards to so the blue line on the support foot is in line with the bottom of the drive unit.

2. Assemble the test stand.

   a. Attach the right-angle clamp to the triangular based stand so the top of the clamp is approximately 10 inches high in reference to the work surface. The height of the right-angle clamp might need to be adjusted based on the ball cup being used or the diameter of the bowling ball.
   b. Attach the burette clamp to the right-angle clamp.
   c. Clamp the back end of the detector/drive unit into the burette clamp. Make sure the stylus on the detector is pointing downward.
   d. Level the detector/drive unit using the small level to be sure it is parallel to the work surface in both directions.

3. Data collection

   a. Open the current excel file used for testing.
   b. Slowly move the bowling ball within the ball cup under the detector. The detector should be lightly touching the surface of the bowling ball approximately centered on the top of the bowling ball.
   c. Push the "Start/Stop" button on the display unit.
   d. Allow the detector to move across the bowling ball and return to its original position.
   e. Record the surface roughness measurements of Ra and RS shown on the display unit in the excel file.
   f. Slowly remove the bowling ball from under the detector/drive unit.
   g. Rotate the ball to a new evaluation area.
   h. Repeat steps c-g until 15 locations on the bowling ball have been measured. The 15 locations should cover the range of all the colors present in the bowling ball avoiding logos and markings, so the overall surface roughness of the surface is obtained.
   i. The average Ra measurement, average RS measurement, Ra standard deviation and RS standard deviation, all in microinches are displayed on the template.
   j. Select File>Save As and Save the file on the network.

If ball results indicate the surface roughness of the ball is out of spec:

1. Verify that the profilometer is operating correctly by testing the reference specimen. The results should fall within 3% of the specimen's expected value. With a 117 µin. reference specimen, the result should lie between 113.49 µin. and 120.51 µin.

2. If the results are within the specified range, the profilometer and data are good.

3. If profilometer fails to match within the specified range, recalibrate the profilometer using the procedure in section #3 above. If the reference specimen reads about ±15 µin. replacement detectors are needed.

Calibration:

These profilometers are to be recalibrated with the reference specimen once a week.

These profilometers are to be verified using the procedure in the previous section before every set of balls.

If any test ball presents values outside of the surface roughness specifications, the profilometers must be verified. Please see previous section for instructions.

Profilometer units only need to be sent off to Mitutoyo when in need of repair. Diamond tip detectors and reference specimen only need to be replaced every 2 years unless diamond tip glue is failing, or a wide worn strip is visible on the specimen.