



**Surface Roughness
Ra & RS
SOP-LANE-4**

STANDARD OPERATING PROCEDURES

Surface Roughness

SOP-LANE-4

SOP CODE



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PURPOSE

To determine the surface roughness of lane panels.

MATERIALS

1. Lane panel or overlay samples to be tested, measuring 6" x 36"
2. Microfiber towel
3. Isopropyl Alcohol
4. Level work surface
5. Mitutoyo SJ-301 Surface Roughness Tester (Profilometer) with stylus
6. Precision surface roughness specimen
7. Mitutoyo SJ-301 Surface Roughness Tester Quick-Reference manual

EQUIPMENT / SET UP PROCEDURE

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 buttonboard, telephone, or opening and closing drawers can cause inaccurate readings).

Set-Up:

1. Assemble the Mitutoyo SJ-301 Surface Roughness Tester.
 1. Supply power to the display unit by connecting the AC adaptor to an electrical outlet and the display unit.
 2. Connect the detector and the drive unit. Do not touch the stylus on the detector.
 3. Connect the drive unit to the display unit via the cable provided.
 4. Energize the profilometer by pushing the button labeled "POWER" located on the right end of the display unit.
2. Program the Mitutoyo SJ-301 Surface Roughness Tester.
 1. Set Date and Time
 - i. On touchscreen, select shift button (button to the right of the section labeled "Condition").
 - ii. Select "I/O" button on bottom left of touch screen to enter I/O Menu.
 - iii. Select "Set" button on top right of touch screen in I/O Menu.
 - iv. Select "Date" button, then "AC" button to clear date. Use numbers on touch screen to enter correct date in the form of MM-DD-YYYY.
 - v. Select "Time" button, then "AC" button to clear time. Use numbers on touch screen to enter correct time in the form of HH-MM-SS.
 - vi. Select the Enter button on bottom right of touch screen.

2. Set Conditions

- i. On touchscreen, select "Condition" button (on top left of touch screen) to enter condition menu page 1 of 3.
 1. Surface Texture Standard
 - a. Select "Stand"
 - b. Select "JIS' 01"
 - c. Select "Stand" to set the surface texture standard.
 2. Measurement Profile
 - a. Select "Profile"
 - b. Select "R",
 - c. Select "Profile" to set the measurement profile.
 3. Profile Filter
 - a. Select "Filter"
 - b. Select "Gauss"
 - c. Select "Filter" to set the profile filter.
 4. Cutoff Length (λ_c)
 - a. Select " λ_c "
 - b. Select "0.03"
 - c. Select " λ_c " to set the cutoff length.
 5. Number of Samples (N)
 - a. Select "N"
 - b. Select "5"
 - c. Select "N" to set the number of samples.
- ii. On touchscreen, select "Page 1/3" button (on top right of touch screen) to enter condition menu page 2/3.
 1. Parameters
 - a. Select "Cust"
 - b. Select "P1"
 - c. Select "Ra"
 - d. Select "P2"
 - e. Select "RS"
 - f. Select Enter to set parameters.
 2. Traversing Speed
 - a. Select 3rd button down on left (shows arrow and detector on rough sample)
 - b. Select "0.01"
 - c. Select title button (same image, above selection) to set traversing speed.
 3. Units (mm/inch)
 - a. Select "mm/inch"
 - b. Select "inch"
 - c. Select "mm/inch" units to inches.
- iii. On touchscreen, select Home button (on bottom left of touch screen) to go to Home Screen.

3. Equipment Calibration (post set-up)
 - i. Ensure that the device is calibrated correctly using the procedure outlines in the Verification section.
 - ii. If device needs to be calibrated, follow the procedure outlined in the Calibration section at the end of the document.

TESTING PROCEDURE

Per ASTM specs, samples must be tested when they are within the temperature range of 70-77 deg F. The room thermostat should be set so the sample surface temperature is between 70-74 degrees. The surface should be removed from packaging to allow the air to circulate and acclimate the sample to the environment for at least 24 hours.

Data Collection

Collect Sample Data

1. Open the Lane Surface Testing Worksheet Excel file where data will be stored.
2. Place the lane surface sample to be tested on the level work surface.
3. Apply Isopropyl Alcohol to lane surface sample and wipe off sample with towel.
4. Allow lane surface sample to dry completely before testing.
5. Place the profilometer body flat on the lane surface sample so the detector stylus contacts the lane surface. Adjust the support foot (metal bracket on the back of the detector) so the detector is level.
6. Push the "Start/Stop" button on the display unit.
7. Allow the detector stylus to move across the lane surface sample and return to its original position.
8. Record the surface roughness measurements of Ra and RS shown on the display unit in the excel file.
9. Move the profilometer to a new evaluation area.
10. Repeat steps 5 - 9 until 10 locations on the lane surface sample have been measured. The 10 locations should cover the span of the lane surface sample avoiding holes or scratches, so the overall surface roughness of the surface is obtained.
11. The average Ra measurement, average RS measurement, Ra standard deviation and RS standard deviation, all in microinches are displayed on the template.

Out of Spec

If results indicate the surface roughness of the lane surface 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 $\mu\text{in.}$ reference specimen, the result should lie between 113.49 $\mu\text{in.}$ and 120.51 $\mu\text{in.}$
2. If the results are within the specified range, the profilometer and data are good.
3. If the profilometer fails to match within the specified range, recalibrate the profilometer using the procedure above. If the reference specimen reads about ± 15

$\mu\text{in.}$ (102 $\mu\text{in.}$ to 132 $\mu\text{in.}$ with a 117 $\mu\text{in.}$ reference specimen) replacement detectors are needed.

VERIFICATION

To verify the profilometer is calibrated properly, use the following procedure to verify the measurement system. This should be completed prior to the beginning of testing a batch of samples.

Verification Procedure

1. Place Mitutoyo 178-602 Precision Roughness Specimen on level table.
2. Place the detector stylus on the precision roughness specimen so the detector is parallel with the measured surface. Adjust the support foot (metal bracket on the back of the detector) so the detector is level. Verify with bubble vial level.
3. Push the "Start/Stop" button on the display unit.
4. Allow the detector stylus to move across the specimen and return to its original position.
5. Record the surface roughness measurements of Ra and RS shown on the display unit in the excel file.
 - a. The results should fall within 3% of the specimen's expected value. With a 117 $\mu\text{in.}$ reference specimen, the result should lie between 113.49 $\mu\text{in.}$ and 120.51 $\mu\text{in.}$ If they do not, the profilometer requires recalibration using the Calibration process below.

CALIBRATION

These profilometers are to be calibrated using the following procedure upon initial set up, any time the device has lost power, when the verification test fails, or when the stylus has been replaced.

Calibration Procedure

1. Place Mitutoyo 178-602 Precision Roughness Specimen on level table.
2. Place the detector stylus on the precision roughness specimen so the detector is parallel with the measured surface. Adjust the support foot (metal bracket on the back of the detector) so the detector is level. Verify with bubble vial level.
3. Select "CAL." button on touch screen.
4. Select value (button in center) and enter the value on the precision roughness specimen (in $\mu\text{in.}$)
5. Select "Start/Stop" button on bottom right of Profilometer.
6. After calibration run has finished, select Home button on bottom left of touch screen to return to main screen.
7. Run verification test to assure the calibration procedure has succeeded.

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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.

