

SURFACE FINISH MEASUREMENT METHOD

Surface finish testing of small-diameter stainless steel tubing measures roughness, or the texture, of a given surface. It is quantified by the vertical deviations of a real surface from its ideal form. If these deviations are large, the surface is rough; if they are small, the surface is smooth. Roughness plays an important role in determining how a real object will interact with its environment.

Although roughness is usually undesirable, it can be difficult and expensive to control during the manufacturing process. Decreasing the roughness of a surface will usually increase manufacturing costs, and this often results in a trade-off between the manufacturing cost of a component and its performance in application. It is of utmost importance to consider the end use of the product prior to determining the desired surface finish value.

K-TUBE MEASUREMENT PROCESS

K-Tube uses a contact surface profilometer (Mitutoyo Surftest® SJ-400) to measure OD/ID surface finish for parts with ID > .017 inch. This method involves dragging a measurement stylus across the surface of the tube. The surface features are measured relative to the drive unit reference surface. This accurately measures waviness and finely stepped features in addition to surface roughness.

The calibrated profilometer reports the results in Rq, Ra and Rz (description and formulas below). "The SJ-400 series is equipped with Rq calibration and step calibration methods for detector calibration (gain adjustment). In both calibration methods only the calibrated value of the precision specimen needs to be entered."¹ No other operations are required to calibrate the tester.

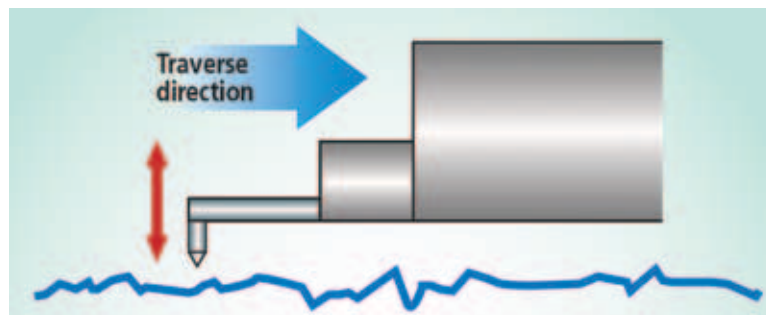
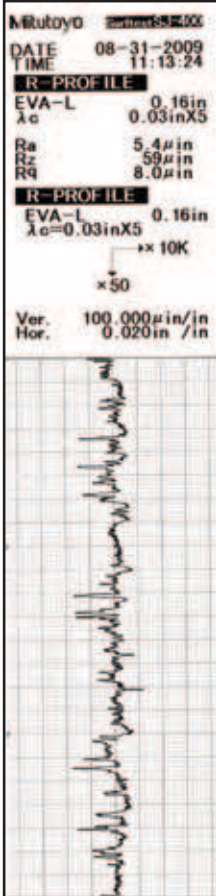


Figure 1: Principle of a contacting stylus instrument profilometer
(Image courtesy of Mitutoyo Corporation)

Sample Preparation & Testing Using Mitutoyo Surftest SJ-400:

1. A 6 inch sample is randomly selected from production.
2. A one inch window is ground into the OD surface so that the ID is visible.
3. Any dirt and metal shavings are removed from the surface with compressed air.
4. Test sample is placed on flat surface and secured from movement during testing.
5. Contacting stylus is placed directly over the center of test sample.
6. Stylus is gradually lowered until it comes in contact with the tube surface.
7. Stylus profiles the surface of the tube, measuring roughness over a distance of 3/16 inch in the longitudinal direction.

AMPLITUDE PARAMETERS



Ra: Arithmetic average of absolute values over the entire sampling length (L)

$$R_a = \frac{1}{n} \sum_{i=1}^n |y_i|$$

Rz: Based on the five highest peaks and lowest valleys over the entire sampling length (L)

$$R_z = \frac{1}{5} \sum_{i=1}^5 R_{p_i} - R_{v_i}^2$$

Rq: Root mean squared (RMS) over the entire sampling length (L)

$$R_q = \sqrt{\frac{1}{n} \sum_{i=1}^n y_i^2}$$

REFERENCES

1. <http://www.mitutoyo.com/pdf/1902SJ400.pdf>

SurfTest is a registered trademark of Mitutoyo Corporation.