

What is a Sanitary Surface Finish?

This blog was created to answer common questions about sanitary and high purity process equipment. One question we ask customers every day is, “What surface finish do you require?”. Many of our customers know what they use or what they need, but few understand what an Ra, grit, or micron rating means in terms of surface finish. Not knowing what you need can lead to unnecessarily expensive fittings with extended lead times. This post will focus on what a sanitary surface finish is and specifically the relationship between Ra, micron, and grit.



A profilometer is an instrument that measures the actual metal surface by dragging a stylus across the metal a predetermined length, measuring the distance between the peaks and valleys of the surface.

To begin, when we say “surface finish” what we really mean is surface “roughness”. Surface roughness is a component of a surfaces overall texture. The most common measure of this roughness is a measurement known as the arithmetic roughness mean, or Ra. The Ra value of a surface reflects the average height or irregularities on a surface from a mean line. Think of this as the measurement of the heights of peaks and valleys along a line. The lower the Ra, the smoother the surface. These values can be measured using a profilometer. It moved a stylus across the surface of the metal and records the differences between the peaks and valleys.

Most commonly measured in micro-inches, Ra provides a simple value for us to make accept/reject decisions. We measure the Ra of a sanitary surface with a profilometer. Traditional profilometers use a diamond stylus that is moved along a surface for a specified distance with a specified contact force. This allows the profilometer to measure small surface variations across the sample.

A corollary to the micro inch is the micron. One micron is equivalent to about 39.37 micro inches. Ra values in both micron and micro inch are interchangeable as they both reflect the arithmetic mean of the average centerline deviations of a surface.

One thing that is not necessarily equivalent to Ra? Grit. Grit is a measure of abrasive grains per given area. The specification of a grit reference does not necessarily equate to a consistent surface finish. A specific grit is used by a mechanical polisher to achieve a

desired Ra. In order to achieve that finish, the right tool needs to be chosen and utilized properly. Selecting and using the right tool is much more an art than a science and is a skill that takes years of practice to acquire.

So why is surface finish important? Smooth, crevice and pit free surfaces, i.e. ones with low Ra readings, are essential to ensure there are not entrapment areas where product can build up and grow nasty things. Entrapment areas can be difficult to clean, allowing bacteria to accumulate. This is obviously undesirable in high purity applications.

Historically, 32 Ra has been the standard sanitary surface finish for the high purity industry. With the advent of stricter regulation of the pharmaceutical and biologics markets, and subsequently process components, increasingly smoother surfaces are being required. Now, process equipment used in a pharmaceutical application will generally need to comply with ASME BPE standards that dictate a maximum surface roughness of 20 Ra or better, depending on the application.

Another finishing polish that can improve a surface finish and the corresponding Ra value for Bio-Pharm applications is electropolishing, a subject which is dealt with in another Tri-Canada Tech Info article.

Standard Grit (Reference Only)	Ra (uin)	Ra (um)	Common Name
60	985	6.3	Mill Finish
180	32	0.8	Sanitary Finish
220	20	0.51	Bio-Pharm Finish
320	10	0.25	Ultra High Purity

Hopefully this post serves as a good refresher on what a sanitary surface finish is. Please email us at sales@tricanada.com for any of your sanitary fluid handling component requirements.