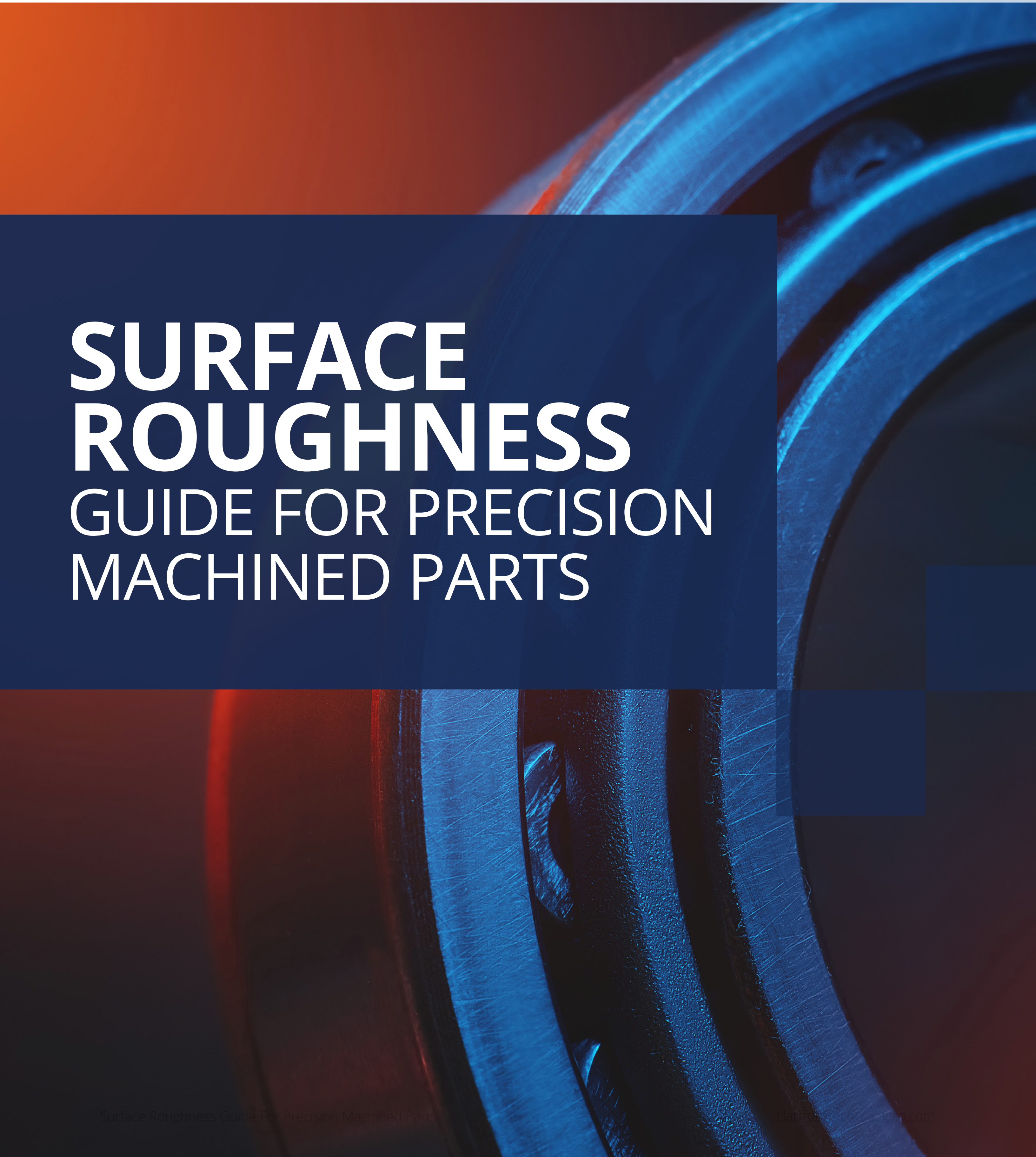
HARTFORD
TECHNOLOGIES



SURFACE ROUGHNESS
GUIDE FOR PRECISION MACHINED PARTS

SURFACE ROUGHNESS GUIDE FOR PRECISION MACHINED PARTS

When metal parts are manufactured, there is always some level of roughness on the surface of the part. This roughness can vary depending on factors such as the manufacturing process, the design of the part, the material used, and additional secondary operations that are used.

It may seem like the roughness of the part surface isn't that important, but it can have a big impact on performance. The surface finish affects the part's resistance to corrosion, how well it performs in terms of friction and durability, the ability of coatings and paints to stick to it, and its appearance.

A smoother surface finish has benefits like reduced friction and a lower risk of surface irregularities. On the other hand, a slightly rougher finish makes it easier to apply paint or coating to the part. The roughness of a part is measured in either micrometer or mico-inch which are respectively in millionths of a meter, or millionths of an inch.

HOW SURFACE ROUGHNESS IS MEASURED

Measuring surface roughness can be tricky because the differences between smooth and rough finishes are so minute. The surface finish of a part is usually evaluated using the roughness, waviness, and lay of the surface. There are several tools and methods used to get an accurate measurement:

CNC Probe

This tool is installed in a CNC machine and helps align the raw material and cutting tools while also measuring the surface roughness. This means you can get a measurement without having to check the surface after machining.

Handheld Surface Roughness Tester

This device has a sensor that measures the roughness of the surface. It's easy to use, but not as accurate as some other methods.

Light or Sound Measurement

This method uses light or sound to measure the roughness of the surface by analyzing the peaks and valleys on the surface.

Measuring surface roughness is important in ensuring the right finish for a part, but it can be challenging because the differences are often small. There are several tools and methods available to get an accurate measurement, and each has its own pros and cons.

THE IMPORTANCE OF SURFACE ROUGHNESS

The surface finish of a part plays a crucial role in its overall functionality and performance. It is as important as the material used for the production of the part. Understanding the different surface finishes and their effects is crucial in ensuring that the right surface finish is achieved. The surface roughness has a significant impact on several factors such as:

Corrosion resistance

A smoother surface finish offers better corrosion resistance as there is less surface area exposed to corrosive materials or chemicals.

Adhesion of paint

A rougher surface provides a better surface for paint or primer to adhere to.

Wear resistance

A smooth surface reduces friction, thus increasing the longevity of moving parts.

Conductivity

A smooth surface offers better conductivity compared to a rough surface. Research has shown that adding just one atom on top of a flat surface, simulating roughness, decreased conductivity by 33%.

Surface defects

A rougher surface increases the likelihood of surface defects developing over time as there are more indentations on the surface.

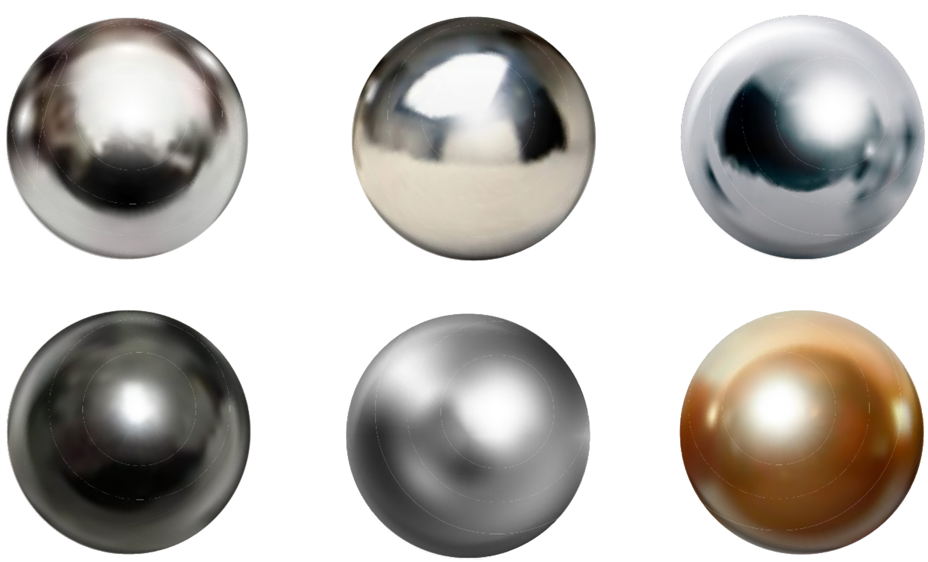
When producing a part, surface roughness is crucial to consider as it can significantly impact its overall performance.

THE INFLUENCE OF MANUFACTURING TECHNIQUES ON SURFACE FINISH

The creation of parts can be achieved through various methods. Each manufacturing method is created to provide a functional surface finish, with a specific tolerance for surface roughness. For instance, the process of broaching is known to produce a surface roughness range of 0.8-3.2μm. In certain situations, additional steps such as grinding or polishing may be required to further improve the surface roughness.

In metal forming, the shape and texture of the object are used to impact the surface finish of the final product. When it comes to cutting metal, factors such as the hardness of the metal, cutting speed, and tools are used to determine the surface finish. Harder metals require the use of sharper tools, which may need to be replaced frequently.

Note that smoother surface finishes usually come at a higher cost, but can result in longer-lasting parts due to reduced friction. The following is a list of typical surface roughness levels for different manufacturing processes.



SURFACE ROUGHNESS CHART

Wondering what the right surface finish requirements are for your component? Although the necessities of each project may differ, the utilization of the chart below can help determine a suitable option for you.

Micrometers Rating (μm)	Microinches Rating (μin)	Application Description
25	1000	A low-quality surface is made by using rough methods like saw cutting or forceful forging, and it's not a good choice for parts that will come into contact with other parts that are moving.
12.5	500	These parts are made to have a rough surface, which is done by using strong cutting tools and rough movements during production. This can be achieved through processes like disc grinding, turning, or milling in a factory.
6.3	250	This roughness should be used for clearance surfaces that have special design or stress requirements. This surface finish occurs from drilling, milling, and disc grinds.
3.2	125	A rough surface is typically recommended for precision components, especially those subjected to vibrations, heavyweight, and intense stress.
1.6	63	A refined finish can be achieved with a machine if the production process is kept under control. This involves using fine adjustments and operating at relatively fast speeds.
0.8	32	A premium machine finish requires precise control and can be easily attained using a cylindrical or surface grinder. It is ideal for products that do not involve constant movement or heavyweight.
0.4	16	This is for a high-quality surface finish that is created by a means of buffing, lapping or honing. It is considered a prime choice when a smooth finish is a priority.
0.2	8	This refers to a smooth and superior surface finish achieved through the process of lapping, buffing, or honing. Machinists utilize this finish when components require a smooth sliding motion on the surface grain of the part.
0.1	4	A smooth surface that some manufacturing companies use if they have to follow certain design requirements. This is the top-notch finish for things like gauges and measuring tools.
0.05	2	This finish is typically creating using a lapping process. G25 balls and precision bearings require this level of surface finish. These components would be used primarily in precision bearings were long life is required.
0.025	1	This finish can only be achieved by multiple lapping operations or electro-polishing. This is the smoothest surface finish one can achieve. Parts with this finish would be used were ultrahigh quality surface finish is required for high fatigue resistance. Ultrahigh precision bearings required this surface roughness.

ABOUT HARTFORD TECHNOLOGIES

When you're looking for a reliable supplier of quality materials, Hartford has the experience to provide the most robust & cost-effective design for your application, backed by a quality lab that is unsurpassed in the industry for its capability & reputation. **We are ISO & IATF certified.**

Hartford Technologies takes a disciplined and methodical approach to ensuring product quality and supply stability. Our manufacturing procedures help eliminate supply chain disruptions and optimize costs, lead times and inventory. With a long history of manufacturing quality bearings and bearing assemblies, you can be confident Hartford knows how to help their customers succeed.

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