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Burnishing For Improved Part Quality And Lower Costs

Burnishing is a versatile process that improves the finish and dimension of precision turned parts. Tools and holders can be mounted on the machine tool to eliminate secondary operations.

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In today's cost-conscious manufacturing environment, what shop owner or production manager would not be excited about achieving accurate size and fine finish on the original machine on which parts are produced? Roller burnishing can help users eliminate secondary operations for substantial time and cost savings, while at the same time improving the quality of their product.

Roller burnishing is a method of producing an accurately sized, finely finished and densely compacted surface that resists wear. Hardened and highly polished steel rollers are brought into pressure contact with a softer workpiece. As the pressure exceeds the yield point of the workpiece material, the surface is plastically deformed by cold-flowing of subsurface material.

A burnished surface is actually smoother than an abrasively finished surface of the same profilometer reading. Profilometers measure roughness height. Abrasive metal removal methods lower the roughness height, but they leave sharp projections in the contact plane of the machined surface. Roller burnishing is a metal displacement process. Microscopic "peaks" on the machined surface are caused to cold flow into the "valleys," creating a plateau-like profile in which sharpness is reduced or eliminated in the contact plane

The burnished surface will therefore resist wear better than the abraded surface in metal-to-metal contact, as when a shaft is rotating in a bushing.

Part Quality And Process Improvements

Roller burnishing was first applied in American industry in the 1930s to improve the fatigue life of railroad car axles and rotating machinery shafts. By the 1960s, roller burnishing was more widely applied, particularly in the automotive industry, as other process advantages were recognized. The primary benefits, related to part quality, are as follows.

- Very accurate size control (tolerances within 0.0005 inch or better, depending on material type and other variables).
- Fine surface finishes (typically between 1 to 10 microinches Ra).
- Increased surface hardness (by as much as 5 to 10 percent or more).

Other process advantages include:

- Reduced cycle time (parts are processed in seconds).
- It is cleaner than honing or other abrasive finishing methods.
- Versatility—it can run on any rotating spindle.
- It can often eliminate slower and more costly finishing processes and secondary operations such as grinding, honing or lapping.

Roller burnishing has long been used on a wide variety of automotive and heavy equipment components (construction, agricultural, mining and so on), including piston and connecting rod bores, brake system components, transmission parts and torque converter hubs.

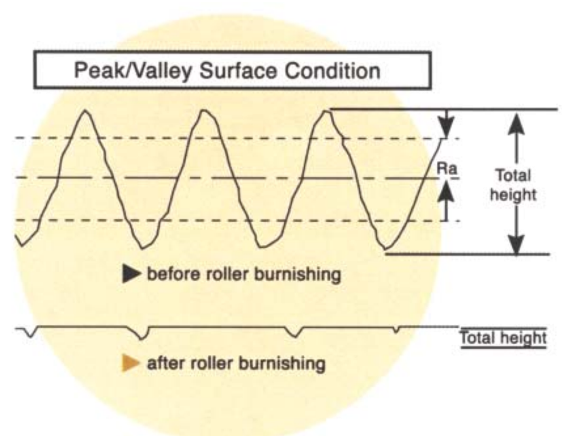
Burnishing tools are also now widely applied in non-automotive applications for a variety of benefits: to produce better and longer-lasting seal surfaces; to improve wear life; to reduce friction and noise levels in running parts; and to enhance cosmetic appearance. Examples include valves, pistons for hydraulic or pneumatic cylinders, lawn and garden equipment components, shafts for pumps, shafts running in bushings, bearing bores, and plumbing fixtures.

An Array Of Designs

Burnishing tools can be designed and built for virtually any part configuration. Standard tools are offered for burnishing inside and outside diameters. Custom tool designs are made to order for faces, internal and external tapers, contours, spheres, and fillets. External burnishing machines are available for burnishing cylindrical surfaces of any length.

The most common burnishing tool designs are rotary tools used to burnish IDs or ODs. Multiple rollers, mounted in a retaining cage, rotate and bear upon a mandrel or race. The tools are adjustable, typically over a range of 0.040 inch for a given nominal size. Adjustments are typically made in 0.0001-inch increments by changing the position of the tapered rollers in relation to the inversely tapered mandrel or race so as to alter the effective tool diameter.

Special tool designs are available for burnishing flat surfaces or tapers. The rollers are mounted parallel to the part surface for flat-face burnishing, or at an angle for burnishing tapers. Internal or external tapers can be accommodated.



Roller burnishing is used to reduce the peaks and valleys that occur in the microstructure of machined parts. The process uses pressure from hardened steel rollers to deform the metal surface by cold-flowing the subsurface material. Eliminating the unstable microstructure is especially critical for optimum performance of wear parts.

Other tool designs use a single roll so the tool can be more versatile, rather than being limited to one particular part configuration and nominal size. A single-roll burnishing tool can be applied to shafts, faces, tapers, contours or large IDs. Tool designs are offered in both boring bar and turning holder styles. Another versatile burnishing tool design uses a replaceable, polished diamond insert instead of a roller. The diamond insert is mounted in a turning holder. The tool produces low microinch finishes on shafts or faces of any diameter.

Part Preparation And Operating Parameters

Only one fast pass of the burnishing tool is required for simultaneous sizing, finishing and work-hardening of part surfaces, provided that proper attention is given to part preparation and tool adjustment. Because no metal is removed, a consistent and tear-free surface is required so the peaks on the machined surface can flow uniformly into the valleys under roll pressure.

An ideally prepared part surface for burnishing is a bored or turned surface of 80 to 120 microinches (Ra). This allows for greater displacement of material on the work surface than would a smoother prefinish, thereby enhancing the sizing capability of the burnishing tool. It also allows the tolerance on the prefinish to be much greater than it would be on a smoother prefinish.

Any ductile or malleable metal can be burnished (steel, stainless, alloys, cast iron, aluminum, copper, brass, bronze and so forth). Because the metal must be capable of cold flowing under roll pressure, hardness normally should not exceed 40 on the Rockwell "C" scale.

Speeds and feeds are not critical to successful tool operation.

Any standard grade, lightweight, low-viscosity lubricating oil, or any mineral, sulfur or soluble oil compatible with the metal or alloy to be burnished, is suitable for most metals. Coolant filtration is very important to keep metal particles or grit from being rolled into the part surface.

Roller burnishing is a faster, cleaner, more effective and more economical method of sizing and finishing parts to exacting specifications. Parts can often be burnished on the original machine on which they were produced, thereby eliminating secondary operations. Burnishing tools can help the user achieve significant time and cost savings while improving part quality.

For more information about burnishing tools from Cogsdill, call (803) 438-4000 or enter **PM *Direct*** *code* ***218BH*** *at www.production-machining.com.*

Generally, a small amount of standard, lightweight oil is sufficient for lubrication of the burnishing. Keeping the metalworking fluid clean to prevent metal particles or grit from being rolled into the finished workpiece is critical for the burnish operation.

Burnishing

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