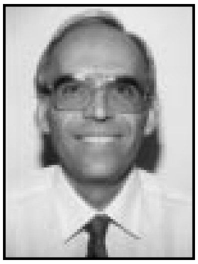

Finishers' Think Tank

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Mass Finishing Review—Burnishing

This is perhaps the most popular mass finishing application. Process attributes include:

- Applicable to all base metals, stamped, drawn, molded parts.
- Produces a bright, smooth, highly reflective surface.
- Removes surface organic soils (oils & greases) and scales, facilitating surface preparation before a plating cycle.
- Can be non-aggressive, where there is very little metal removal from the surface.
- The focus is honing and removing surface imperfections.
- Base metal surface is leveled and polished prior to additional finishing steps.
- Improves brightness and leveling of the plated finish. Where applicable, the plating thickness can be reduced.

Burnishing is a measure of the distance between high and low points on a metal surface (peaks to valleys). This can be instrumentally measured and interpreted as an RMS (root mean square). The lower the RMS value, the flatter or more leveled the surface. An RMS value of 1, for example, describes a more highly burnished surface than one having an RMS of 5. There are two classifications for burnishing:

1. Burnishing. Parts are processed with either ceramic or porcelain media, or without media (part on part). The expected finish is for general brightening and leveling.

2. Ball Burnishing. Parts, usually softer metals such as aluminum and brass, are processed with case hardened steel or stainless steel media, producing maximum brilliance. This can be accomplished before transfer to a plating cycle or after plating, to improve final luster of the finish.

Shine rolling is another mass finishing process that has some similarity to burnishing. In shine rolling, parts are usually processed without media for purposes of deburring and enhanced luster.

Burnishing compounds are available as powder and liquid concentrates. Effective burnishing compounds should contribute these operating benefits:

- Provide a thin lubricating film—lubricity is very important.
- Water hardness tolerance.
- pH buffered for the application.
- Rust and corrosion inhibition.
- Flexible foaming characteristics (high or low).

Active components of the burnishing compound work on the part surface, leaving a residual film. This is usually seen by the water break condition after rinsing. Standard soak cleaning should remove this film as part of a surface preparation cycle before plating. Application features for burnishing systems vary somewhat between liquid and powder concentrates.

Application—Liquid Type

- Significant handling and control benefits in flow through vibratory systems.
- Easily used in horizontal and oblique barrels.
- Meter as pre-diluted or in ratio with water.
- The working solution concentration may range from 0.5-2.0% v/v.
- In vibratory equipment, the solution works through the load and drains at a continuous flow rate of 1-5 gal/ft^3/hr.
- Per the surface finish requirement, the solution pH may range from 3 to 11.

A liquid system offers several benefits. Direct handling of the material is minimal, benefiting worker safety. In some applications, a sufficient amount of product may be consumed permitting the use of returnable drums or totes, eliminating disposal requirements. The concentrate as a pre-diluted working solution is metered in at a fixed rate, continually delivering fresh, active working solution to condition the parts. Equipment requirements are rather simple. The drum of stock solution is connected to a calibrated pump, set to deliver the prepared solution at the preferred flow rate. Depending on quality and effectiveness of the "one-pass" solution, it may be recycled until determined to be spent. Maintenance of and monitoring the established process cycle is not critical, permitting other tasks to be conducted while the burnishing cycle is running. Other than the enclosed horizontal barrel, parts can be easily sampled to examine progress of the cycle. In horizontal and oblique barrels, the concentrate is added along with water and optional media. Final preparation is made before the barrel burnishing cycle is started. All these benefits and simplified operation are contingent upon proper cycle development by trial and error. In fact, this is true for any of the mass finishing process cycles to be run.

Application—Powder Type

- Preferably added to horizontal and oblique barrels. Although use in vibratory equipment is compatible, especially for shorter cycle runs.

- Addition rates of 1-4 oz. burnishing compound/gal. of water.
- Working solution containing parts and optional media tumble for a desired time.
- Working solution pH range may be mildly acidic, but more toward pH range of 7-10.

Troubleshooting Tips

Problem	Possible Cause	Correction
Dull, hazy finish	Oil & grease emulsified in film	Preclean parts before burnish
Dull (no oily soils)	Scale	Descale first
Parts stained, rusty, tarnished	Insufficient drying of wet parts	Dry quickly after rinsing
Media & parts float	Excess compound/water	Adjust concentrations
Parts cushioned	Excess compound	Adjust concentration
Rust/corrosion	Very low conc. of compound	Adjust concentration
Scratchy, dull	Very low conc. of compound	Adjust concentration
Media/parts corrode	Very low conc. of compound	Adjust concentration

The powdered burnishing compound is added new for each cycle run, thereby ensuring fresh, optimized chemical mix to condition parts. Some powdered systems offer benefits in that particular active components may be formulated into the blend exceeding the amount that can be dissolved into a liquid product. Soaps, certain conditioners and surfactants would be so affected. Powdered burnishing compounds are just as effective in the process cycle as their liquid counterparts. The differences being handling and application as discussed previously.

Additional Facts

- Burnishing cycles typically range from 20-60 minutes. Longer cycles may be required, based on specific testing and evaluation.
- Rust inhibitors protect steel parts and especially steel media for long, dependable service life.
- Inhibitors prevent tarnishing and darkening of brass and copper alloys, corrosion of zinc and aluminum.
- Specially blended burnishing systems can deburr and burnish aluminum alloys and castings, eliminating preliminary etch and desmut treatments. Not a replacement for preparation prior to zincating.
- Acidic burnishing effectively removes smut and carbon deposits off steel after descale and deburr before alkaline burnishing to final high luster.
- Descale, detarnish and burnish copper, brass and bronze in one step.

Media

Six shapes of case-hardened steel media are normally used: ball, ball cone, diagonal, oval, pin and wheat. The ball is best used, unless specific geometric shapes result in lodging or insufficient media-to-part surface contact. Keeping steel media clean and protected with a rust inhibitor will prevent pitting and rusting. Simple preventive maintenance can result in reliable use of steel media for several years.

Ceramic and porcelain types are available in surface finishes that permit their use in deburring or descaling and burnishing, without the need to change the media. These types may exhibit a smooth, glazed surface, containing a fixed amount of selected abrasives. Different shapes preferentially work on and condition specific geometrically formed parts. Keeping the media clean is critical to effective burnishing.

Generally, media-to-parts ratios of 10–20:1 are used in burnishing cycles. This, in relation to chemistry and concentration of the burnishing process and mechanical action of equipment, are factored into optimum media-to-parts ratio. A more detailed discussion of these media, application and ratios to parts is described in last month's "Mass Finishing Review" article in *P&SF* (July issue, p. 8).

Equipment

Horizontal and oblique barrels are charged with media, burnishing compound and sufficient water. For many processing cycles, loading the barrel to 50-60 percent of total capacity is sufficient. This loading and speed of the barrel are critical to obtaining the best slide zone. This is where parts, media and active chemical slide together to facilitate optimum action of media and chemical on the parts. Since this only occurs during the downward slide in the barrel, trial and error to determine proper loading is essential. Barrel speed must also be set to prevent centrifugal forces (usually at too high rpm) that would prevent the parts from sliding.

Vibratory equipment makes use of vibrational and rotational energies to work with media and burnishing chemicals. Mechanical work is constantly being performed on parts. The effect is faster action, resulting in lower process cycle times, compared to barrel finishing. Trial evaluations should be conducted to optimize energy setting of equipment in relation to chemistry type, concentration and media-to-parts ratio.

Quality is associated with any finishing process. A lack of it will surely affect the final coating or wear resistance parameters. Sufficient input into the process cycle will have a positive influence on appearance and protection/wear properties. One of the most practical troubleshooters I had the pleasure of working with, Mr. Tom Mountain, put it best: "Quality is like a computer. You program garbage in, you get garbage out. Program quality in, you get quality out." P&SF

Finishing Trivia

- Alkaline soak cleaners, high detergency containing silicate are preferred for removing chlorinated oils, which tend to form tacky jellied masses in caustic-soda-containing soak cleaners.
- There is little benefit to adding an iron control agent to a bright nickel bath containing precipitated iron sludge. Most iron control agents will redissolve the iron sludge, compounding the bath contamination. The purpose of adding an iron controller is to maintain ferrous iron (+2), that will gradually plate out. It's preferred to high pH-treat an iron-contaminated nickel bath, removing the iron, before initiating iron control additions.
- Iron phosphating baths are controlled by pH measurement and bath acidity titration. Zinc phosphating baths are controlled by analysis of total and free acid ratios, iron and activator.