Chemical Accelerator Mass Finishing

Q. We manufacture hardened steel gears of all types and sizes. We have a vibratory machine, but it's been ineffective in smoothing our grinding lines. Can you recommend a vibratory or mass finishing process?– *H.P.*

A. We recommend a chemical accelerator process in your vibratory machine. The machine must have a precise flow-through soap compound system, and coated or stainless drains. Chemical accelerator finishing processes can be accomplished in vibratory, high-energy centrifugal disc, spindle and drag finishing systems. The process produces super surface refinement (in the 2-to-4-Ra finish range) and keeps edge radiusing to a minimum.

Chemical accelerators (oxalic acid, phosphates or citric acids) are metered into and carried by a cutting or non-cutting, high-density (110 to 140 lbs per cu ft), preformed media. The accelerator chemical continuously oxidizes the surface of iron-based and some non-ferrous metal alloys, enabling the high-density ceramic media to remove metals at much higher rates. The accelerator system cuts, refines, and brightens surfaces within the same machine and media.

The vibratory chemical accelerator system has a low initial equipment cost for the amount of material it's capable of removing. A key component to all chemical accelerator systems is an accurate compound delivery system. This system uses two compound pumps and flow meters to deliver the refinement accelerator chemical, and then a burnishing compound for brightening, if required.

Applications for chemical accelerator systems include refinement and decorative finishes on hand tools, surgical instruments, medical implants, gun parts, knives, pre-plate finishing, air foils, stator rings, gears and bearings.

In particular, the gear industry (within the aerospace, automotive, wind-steam-and-gas turbine industries) has found that accelerator processes improve gear life as much as three times. The process will:

- Reduce gear friction, running temperatures and wear
- Reduce gear noise and vibration
- Increase oil retention
- Remove manufacturing process lines produced by cutting, grinding, hobbing or honing
- Eliminate manufacturing corrosion superior to bead blasting
- Increase fuel economy
- Obtain 2 to 4 Ra finishes in the root fillet areas
- Increase load capacity of gear lubricant.

Chemical accelerator mass finishing is an excellent process for your gear finishing.

Stainless Steel Deburring

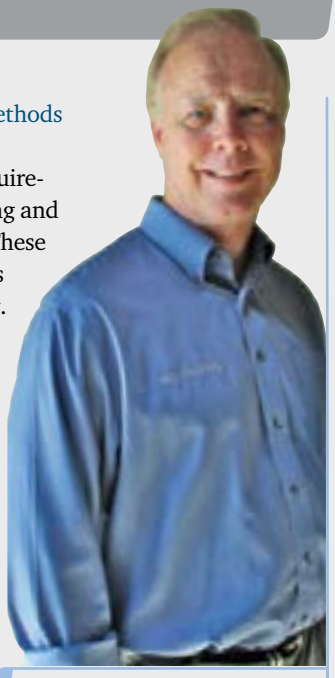
Q. We are cutting and machining a 304 stainless, 2" diameter by 5" long, cold-rolled, 2B-finished round tube. We need to deburr the parts, but we also have to blend the machined areas to match the original 2B mill finish. Some of the same parts also require a #8 finish. What is a #8 stainless finish, and can we use vibratory methods for our requirements?– *J.K.*

A. You have three finishing requirements: deburring, refinishing and refining an existing finish. These are all excellent applications for vibratory/mass finishing.

Let's define the two finishing specifications (2B and #8) and then discuss the vibratory process solutions.

Finish Specification:

Stainless steel finishes have been standardized by the Stainless Steel Sheet Manufacturers Association. Two of the standard finishes are the 2B and #8. Below are their descriptions and how the mills arrive at these finishes.



PAT WENINO / M.C. Finishing
massfinishing@pfonline.com

2B is a cold-rolled finish with a final polish-roll pass that produces a matte finish with a minor sheen. This is the standard and most common stainless sheet, plate and cold-rolled tubing finish. Standard 2B mill finishes are on both sides of the sheet.

#8 is a bright, buffed finish with no lines. It is produced by the mill starting with a 2B finish, then multiple passes with a rigid heavy-duty wide-belt sander using a 120-grit-, 150-grit- and then 320-grit-coated abrasive polishing belts.

2B finish

#8 finish

The sheet is then finished with a sisal-cut buff process that produces a fine-line, bright finish. The final finish process is a color buff that removes the fine lines and produces a luster finish— expensive to produce but popular in the architectural and food-grade industries. Standard #8 finishes are on one side of the sheet.

Vibratory Process Recommendations:

To deburr and refinish the machined area to its original 2B finish, we recommend a one-step, 1-hr vibratory process using a ⅜" × ¼" ceramic triangle media capable of cutting with a good finish. This should include a flow-through compound system using a soap that lubricates and brightens to assure a consistent finish. The vibratory machine should be set up to produce 4 to 5 mm of amplitude of energy.

To obtain the #8 finish, we recommend the following:

1. Start with the 1-hr ⅜" × ¼" triangle media process described above.
2. Use a secondary 2- to 3-hr process with a ⅜" high-density zirconium polyester plastic cone cutting media. The same compound and machine setting can be used as in step 1. This will smooth the surface and prepare it for the final third-step brightening process.
3. Brighten/burnish with a 1-hr process in a 3- and 4-mm mix of porcelain burnishing ball media. Use an acidic (4-5 ph) burnishing compound with very low flow rates to avoid excessive foaming. Use the same machine amplitude setting as in steps one and two.

Water quality will vary from city to city, which can affect the brightening process. Try DI water for better results.

This three-step mass finishing process for the #8 finish will not remove excessive imperfections such as scratches, pits or dings. A 320-to-400-grit-coated abrasive polishing process prior to the mass finishing process may be required. Excessive machining lines may also require an increase in the step-one ceramic cut process time cycle.

A round stainless tube requiring a #8 finish is a great application for mass finishing because of its round, single-point reflectivity. A large flat area part requiring a #8 finish is less successful, because a flat surface area reflects more visual surface depth, which amplifies any imperfections, therefore requiring a polishing/buffing process.