Finish That Stainless Steel!

Once you reach agreement with a client on a finish, it's important that you choose the right materials, tools, and use the correct technique for the finish type selected.

BY CHRIS STONE

Lehigh Valley Abrasives

In North America, the use of stainless steel continues to grow in popularity both inside and outside the home due to its many advantages. Architects, engineers and contractors increasingly specify stainless steel for use in construction, appliances, food processing equipment and the medical field. As stainless steel usage continues to grow, proficiency in finishing will take on increased importance.

For fabricators, the ability to proficiently fabricate and finish stainless steel, can lead to both increased business and profitability. The most effective fabricators follow a three step process for stainless steel finishing projects. The first step involves working with the customer in order to define and document the finish required for the project. Next the fabricator must choose the correct abrasives and power tools that will be used on the job to achieve the required finish. And finally, the fabricators must create and execute the mechanical finishing process plan in order to complete the project and satisfy the customer.



The first step for fabricators is to work with each customer

to define the finish required. The finish for the base material and treatment of the welds should be discussed and agreed upon. Generally, the material finish is specified in grit (the particle size for the last step in

Three steps to finishing stainless steel:

Define the finish Choose the right abrasive and power tools Finalize & execute the plan

the abrasive finishing process). Stainless steel material specifications are defined below.

Mechanical Finish Designations for Steel Materials

- **#2D Finish** a uniform, dull silver gray mill finish that is applied to thinner stainless steel coils, the thickness of which has been reduced by cold rolling.
- **#2B Finish** A bright cold rolled mill finish commonly produced in the same manner as No. 2D, except that the final light cold rolling pass is done using polished rolls.
- **#3 Finish** A semi-polished surface achieved by finishing with the equivalent of a 80 to 120-grit abrasive. This finish has a pronounced grit line.



A sample swatch can be made out of tubing. This sample shows a #7 finish, with welds ground flus and pit and crevice free (similar to NOMMA #1 finish).

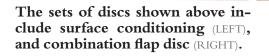
- **#4 Finish** Also called brushed, directional or satin finish A number 4 finish, characterized by fine polishing grit lines that are uniform and directional in appearance. The final abrasive used in the process is 150 to 220 grit.
- **#6 Finish** Polished finish achieved with the equivalent of a 240-grit abrasive. Finer grit lines and higher reflectivity than n No. 4 finish.
- **#7 Finish** Highly reflective surface obtained with the equivalent of a 320-grit abrasive. Minimal grit lines.
- **#8 Finish** or Mirror Finish produced by polishing with at least a 320 grit belt or wheel finish. The part is then sisal and color buffed to achieve a mirror-like finish.

Weld Treatment

The treatment of the welds should also be defined with the customer. Weld treatment options are as follows;

- 1. Remove weld spatter and discoloration only.
- 2. Remove weld spatter, discoloration and weld ripple.
- 3. Remove weld spatter, discoloration and weld ripple, plus grind weld smooth with base material.
- 4. Remove weld spatter, discoloration and weld ripple, plus grind weld smooth with base material, and producing all welds pit and crevice free.







Once the customer and fabricator have defined the material finish and weld treatment, a sample swatch can be created to use as reference. The sample swatch can be as simple as two pieces of stainless steel square tubing welded together and finished per the aforementioned specifications.

Step two CHOOSING ABRASIVES AND POWER TOOLS

Choosing Abrasives

Discs and belts are the most popular abrasive mediums for mechanical finishing of stainless steel. Most often

abrasive discs are used for weld treatment, and belts are used for material surface treatment. The one notable exception is the use of Dynafile small portable belts for treating welds in hard to reach locations.

The following illustrates the typical mechanical finishing steps for weld treatments along with the appropriate abrasive.

For removal of excess weld, spatter and discoloration, use the following abrasives:

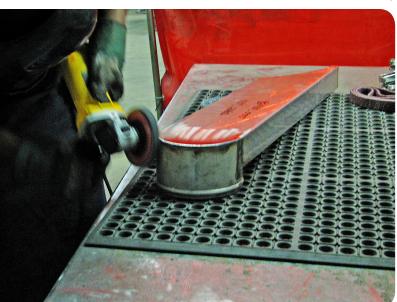
- Grinding wheel
- Resin fiber disc
- Abrasive flap disc
- Dynafile coated abrasive belt

For creating a uniform scratch pattern in weld, use the following abrasives:

- Weld disc
- Surface conditioning disc
- Unitized disc
- Dynafile coated surface conditioning belt

The advent of the flap disc has significantly reduced the steps required for stainless steel finishing. In the past, operators used a two step process for weld treatment consisting of a grinding wheel for the first step (material removal) and then a resin fiber disc for the second step (uniform scratch pattern).

Increasingly, the flap disc is replacing the older two-step process with a single step, requiring only one abrasive product. Layers of coated abrasive are arranged on a backing pad in a fan like arrangement. In addition to reduced processing times, flap discs are less prone to gouging and scratching the work piece (very common with grinding wheels). Gouging and scratching can significantly increase downstream polishing times.



An employee is using a unitized disc to create a #4 finish. Notice the operator's use of a protective rubber to prevent the material from scratching during polishing.

When sequencing abrasives, fabricators should work from coarse to fine.

For finer weld finishing, a bevy of new products are now available that improve surface finishes and reduce polishing times. The newer products include surface conditioning flap discs, combination flap discs, and unitized disc. Surface conditioning material is a nylon web impregnated with abrasive grit. The material is available in coarse (50-80 grit), medium (100-150 grit), fine (180-220 grit), and very fine (240 -360grit) and produces a matte like finish when applied to stainless steel. Combination discs combine coated abrasive and surface conditioning on the same backing pad in an interleaf pattern, thus removing the weld and polishing at the same time. Unitized discs consist of layers of non-woven material impregnated with abrasive grit. They are available in coarse through fine grits and excel at producing fine finishes on stainless steel welds.

Abrasive Belts

As previously discussed, belts are generally used to process larger material surface areas. The two main categories of abrasive belts used in stainless steel finishing are coated and surface conditioning.

Traditionally, zirconia-coated abrasives belts were used for stainless steel finishing. However, the introduction of newer ceramic grain belts caused a rise in popularity of stainless steel finishing. The newer ceramics offered by leading coated abrasive manufacturers, such as VSM Abrasives and Norton Abrasives, require less pressure, last longer than other coated abrasives, and cut cooler particularly important for stainless steel finishing as heat generation is an obstacle to effective finishing.



Ceramic grain flap discs are used to remove the weld in a pre-polished stainless steel square to round transition.



This Metabo grinder offers variable speed vibration reduction.

Belts made out of surface conditioning are generally applied after the coated abrasives do their work. The surface conditioning belts texture more than remove material. The belts generate the appearance of a linear brushed finish on the material.

When sequencing abrasives, fabricators should work from coarse to fine. Skipping more than one grade level when moving finer in grit tends to give the material an uneven choppy look. When

blending welds and large surfaces, using longer strokes will result in a more even appearance.

Power Tools

While the angle grinder is still the workhorse for stainless steel weld finishing, linear belt finishing tools are required to achieve the higher level stainless steel finishes that are more frequently being specified. Power tools are available as pneumatic or electric. Pneumatic tools offer the advantage of being lighter, and therefore, easier for the operator to hold and handle. On the other hand, electric power tools offer the advantage of more power and variable speed control.

The ability to control the speed of the tool is essential for stainless steel finishing. As the surface finish becomes finer, the speed of the tool must be reduced to achieve a uniform appearance in the surface finish. Therefore, fabricators attempting #4 finishes and finer, need to have variable speed angle grinders and linear belt finishers in their workshops. By reducing finishing speeds as the surface finish becomes finer, abrasive consumption is also reduced resulting in the need for fewer abrasives to complete the project.

New grinders, such as the WE14-125VS from Metabo, offer variable speed, vibration reduction, quick wheel change and a powerful 12 amp motor. The yellow dial at the bottom controls the speed. This 6" unitized disc must be run at 3000 rpm (a normal grinder runs at 11000 rpm) and will grind and polish the corner weld in a single step.

For linear finishing and blending welds with adjacent pre-polished material,



The Dynafile is ideal for hard-to-reach areas. They are ideal for areas that can't be reached by a grinder or polisher.

variable speed burnishing machines such as the flex machine below, allow operators to more easily achieve desired finishes in stainless steel. It is important to note that a linear scratch pattern (frequently specified for stainless steel finishes) cannot be achieved with an angle grinder. The angle grinder will leave swirl marks in the material. Only a burnisher, like the unit below, can achieve the desired finish.

A relatively new class of power tool has been gaining popularity for polishing pipe and hand rails.



The pipe sander wraps 270 degrees around the work piece and quickly accomleft: plishes finishing tasks with ease. The pre-tensioned arms apply even pressure to the workpiece producing a uniform finish.

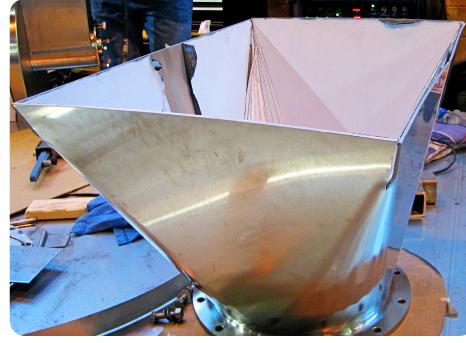
The pipe sander wraps 270 degrees around the work piece.

The Dynafile is another tool required for most

stainless steel finishing jobs. The tool accepts small portable belts and excels at accessing hard to reach areas. Dynafiles are typically used where access to use the grinder or polisher cannot be gained.



The final step is to create the mechanical stainless steel finishing plan and execute completion of the project. This involves pre-planning the actual work steps involved in order to complete the required finish. Each work step should list the power tool, abrasive type and grit which will be used.



The inside of this part is pre-polished and protected with platic film during the manufacturing process. The film is peeled back at the welded seams.

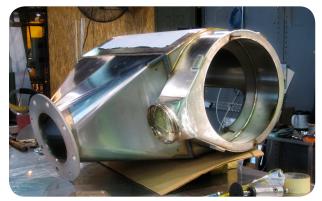
Nowhere is preparing more important than in the area of mechanical polishing. By carefully planning the project, hours of needless re-work can be avoided. If fabricators are attempting a finish they have not achieved in the past, they may want to consult with their abrasives and power tool distributor for guidance.

The following points should be considered during the planning process:

- 1. Ordering pre-polished material when possible.
- 2. Protecting the material with a plastic film coating.
- 3. When possible using TIG welding.
- 4. Minimize weld diameter and spatter.
- 5. Pre-polishing parts that have difficult access points.
- 6. Educate employees concerning care in material handling (stainless steel is easily scratched).

Part in Finishing Process

In summary, the three steps critical to successful stainless steel finishing include defining the customers, requirements, planning the sequence, which includes choosing the abrasives and tools that will be used, and executing the plan. By adopting this approach, fabricators can fulfill their customers' requirements in the least time and with the least cost. ■



Part in finishing process.

About the Author:

Chris Stone is owner of Lehigh Valley Abrasives, supplier of abrasives and power tools for metal working.

This article was printed in the September/October 2009 issue of *Fabricator* magazine.

For more information: www.lehighvalleyabrasives.com email: info@lehighvalleyabrasives.com