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Are You Focused on Being Agile, Lean, or Both?

Manufacturers are being faced with numerous regulatory compliances. Recently, 131 manufacturing organizations wrote to the White House requesting that the administration curb the federal regulations (foxnews.com/media/131-manufacturing-organizations-biden-white-house-stop-unprecedented-regulatory-onslaught). Considering this, and to remain competitive in the marketplace, I believe it is critical for all manufacturers to fully embrace methods to better compete.

Lean manufacturing is more than just a concept. It is a systematic approach to streamlining and optimizing processes within a manufacturing environment. The focus is on reducing waste, improving efficiency, and increasing value for the customer. Hence, the principles of lean manufacturing have long proven effective in a wide range of industries, and companies have adopted lean manufacturing practices to improve their operations and profitability.

Agile manufacturing focuses on quickly adapting to customer demands and changing market conditions by using flexible and cross-functional teams, rapid prototyping, and modular equipment and/or cells. It values experimentation, collaboration, and continuous improvement. This option focuses attention on the core competencies a manufacturer must possess to be competitive. Lean manufacturing, on the other hand, aims to eliminate the waste in the production process, minimize inventory, reduce defects, and optimize workflows. Both approaches strive to increase efficiency and reduce costs but also prioritize different strategies.

To start implementing these methods, welding professionals should first understand the economics of welding and cutting. This should begin with a clear understanding of arc welding cost definitions and equations used to estimate the direct costs of arc welding, including welding process deposition efficiency, shielding gases and delivery systems, and efficient weld joint designs. These are all considered manageable costs, including, but not limited to, mistake-proofing layouts, production planning, and upstream material preparations. Quality must also be a factor in controlling and managing welding and cutting costs. However, the cost of quality is not always obvious; weld repairs usually average two to four times the original cost in fabrication or construction projects. Additionally, inadequate quality will usually impact manufacturers’ reputations and opportunities for repeat business.

These manufacturing approaches can result in the overall end goal of reducing cycle times associated with product fabrication and improved throughput, defined as the sum of the time required to complete the product from order receipt to shipment and final payment.

I’ve worked with numerous facilities to implement the proper and most-economical welding process procedures. I’ve suggested they invest in 180- to 360-deg welding boom arms, implement two to three axis positioners, switch to suitable shielding gas cylinders that can eliminate waste, use only the needed length of gas hoses and proper flow rates, check all connections and welding leads for leaks, switch to higher-accuracy thermal cutting machines, and train welders to produce and measure only the required weld sizes. And like magic, they improve efficiency, deposition rates, and ergonomics while reducing waste, all without too much investment other than the willingness to act. It is important to note that short- or long-term success in any of these key business performance areas takes an effective change agent or lean implementer assigned or contracted to drive results.

Consider courses and training in lean management or the online courses that AWS offers, such as Economics of Welding and Lean Management for Welding Productivity, as well as the AWS Certified Welding Supervisor seminar. There are other training options available to understand all the tools one can place in their lean welding manufacturing toolbox, and the return on the investment is well worth the effort. It starts with the motivation to do it and taking the first step. Let’s get started by reviewing this month’s Welding Journal and taking notes for planning how you will begin. As author C. D. Jackson observed, “Great ideas need landing gear as well as wings.” Any idea that remains only an idea does not make a significant impact.
Metal grinding is a demanding job. But it can be made easier by choosing the right product and the right tool for the specific application and using them properly.

When an application calls for weld blending, bevel creation, or heavy material removal to get a part to a certain dimension, portable grinding wheels are an efficient choice. However, getting the best performance out of grinding wheels requires attention to a few key factors. Learn more about grinding wheel options and get tips to optimize productivity when using these wheels in a manufacturing or fabrication application.

**Benefits of Portable Grinding Wheels**

Portable grinding wheels, which are typically used on handheld right-angle grinders, provide versatility and portability because they can be taken to the workpiece. They are also capable of removing a lot of material quickly. This helps operations focus on productivity and move on to the next job faster.

Type 27 grinding wheels, which have a flat grinding side profile with a depressed center, are the most common portable abrasive grinding wheels and are often ¼ in. thick. Typically, when grinding wheels are designed to last longer, they cut slower, and vice versa. But there are grinding wheels on the market specially formulated to maintain speed while still delivering longer product life. This helps operations
increase uptime and reduce wheel changeover, saving time and money.

Another common wheel choice for industrial applications is a Type 27 combination wheel in ¼ in. thickness. Some combo wheels can be used for grinding, cutting, and notching, making them extremely versatile.

Grinding Wheel Options

To choose the right grinding wheel, it’s important to consider the needs and requirements of the application, including the workpiece material, the tool being used, and the desired result — Fig. 1. Many factors differ from wheel to wheel. Different abrasive grains, resin formulations, additives, and fiberglass reinforcements all play a role in the results, along with wheel performance and life.

**GRAINS:** Consider some of the most common grain options. Aluminum oxide is an abrasive grain that is ideal for steel, iron, and other metals in general purpose applications. While it provides fast initial cutting, this grain dulls over time and lacks the cut rate and potential longevity of some other grains. Ceramic alumina grains offer the benefits of self-sharpening and give consistent performance over the life of the grain because as it breaks down, it constantly exposes sharp grain. Some options expose more sharp grain points due to microfracturing technology. They offer a long operating life under moderate pressure and are ideal for hard-to-grind metals, such as titanium, Inconel®, or stainless steel. Silicon carbide is an extremely sharp and fast cutting grain that is also friable, so it’s not as tough as other grains. It tends to work best with softer materials, like aluminum, and is often used in products designed for stone, concrete, or ductile iron. Zirconia alumina is a tough grain that offers self-sharpening capabilities under multiple types of applications, including those that require heavy pressure.

**FIBERGLASS:** The fiberglass in a wheel is the support that holds the product together. It provides reinforcement and rigidity and affects grinding ability. Fiberglass comes in different weaves and thicknesses. Look for combination wheels that offer triple layers of reinforced fiberglass, which gives additional support and strength for multiple applications and aggressive stock removal.

**BONDS:** The bond is the substance that causes the abrasive mixture to adhere and hold the abrasives’ intended shape. Bonds consist of different materials, including dry and wet resins and multiple additives. The bond on a grinding wheel may be hard, soft, or somewhere in between. A harder bond typically extends the wheel’s lifespan provided the user operates and maintains the wheel correctly. A softer bond allows for smoother grinding and exposes new grains more quickly. Choosing the correct bond for a given application and material can help balance performance and longevity while also increasing control and reducing chatter and operator fatigue.

Tips for Improving Productivity

Making the tough job of grinding as productive as possible comes down to several factors. Here are seven tips to help optimize grinding wheel productivity.

**TIP 1 Choose tools carefully**

Tool power makes a big difference in grinding wheel performance. If the tool doesn’t have enough power or torque, the operator won’t get the full performance of the wheel as it’s designed. For example, a product that contains ceramic alumina requires a higher-powered tool to ensure that the operator gets the full advantages of the self-sharpening grain. Even something that seems small, like the choice of the extension cord, can affect wheel performance. Depending on the length, using a 10- or 12-gauge heavy duty extension cord vs. a 16-gauge, for example, makes a difference in the performance of the wheel and also the heat that is generated in the cord. Always avoid stringing together several cords.

**TIP 2 Start with a pull motion**

With a new grinding wheel, start by using a pull motion, rather than a push motion, for the first few strokes. This helps break in the edge of the wheel, prevents initial gouging of the workpiece, and familiarizes the operator with wheel performance. If the application allows it, use long, smooth movements and avoid short, choppy strokes. This gives consistent material removal in the work area and reduces the chance of digging into the workpiece, which can create costly rework.

**TIP 3 Don’t dwell**

It’s important to keep steady, consistent movements and avoid dwelling in the same spot when using a grinding wheel — Fig. 2. Otherwise, heat will build up and could cause discoloration on high-value workpieces. Dwelling in the same spot can also result in removing too much material, potentially adding costly rework.

Fig. 2 — It’s important to keep steady, consistent movements and avoid dwelling in the same spot when using a grinding wheel.
Use proper pressure and orientation

Operators may think that pressing harder will get the work done faster, but too much pressure on a grinding wheel can cause problems and increase operator fatigue. Use moderate pressure and let the wheel do the work — Fig. 3. The orientation of the wheel to the workpiece also plays an important role in performance and productivity. The optimal angle for using a grinding wheel is typically 25 to 35 deg. It can be used safely at a shallower or steeper angle depending on the application, but you will not achieve the same life or efficiency. Also note that not all 1/8-in. combination wheels are created equal. Some are specifically designed to cut and grind while others are for vertical use only. Make sure your technique matches the instructions on the wheel. If it says the wheel is for vertical use only, don’t use the wheel to grind on its face.

Fig. 3 — Use moderate pressure and let the wheel do the work. The orientation of the wheel to the workpiece also plays an important role in performance and productivity.

Optimize wheel life

Using a wheel for its full usable life helps operations reduce wheel costs as well as the downtime spent on changeover, which in turn helps improve uptime and productivity. Take advantage of technologies that help optimize wheel life. For example, Tiger® 2.0 cutting, grinding, and combo wheels from Weiler feature a patent pending Optimum Use Line, a visual indicator that helps operators use the wheel safely to its full life.

Keep a focus on safety

Some simple things to keep in mind include making sure the maximum rpm listed on the product is higher than the maximum rpm listed on the tool. Also, be sure the wheel fits under the tool guard that is installed on the grinder and keep the guard on the grinder. Edge chipping or breaking can become a safety hazard if fragments fly off the wheel while it’s in use. The Tiger 2.0 wheel is formulated with antichip technology to extend wheel life and reduce the potential for edge chipping or breaking, allowing the wheel to wear down smoothly. In addition, QR codes on the wheels provide operators with instant access to safety information — Fig. 4.

Fig. 4 — QR codes on the new wheels from Weiler provide operators with instant access to safety information.

Consider the application

One of the first steps in choosing the right wheel for the application is to consider the job being done. Specific wheel designs and formulations are available for many applications and materials. For example, in multipass welding, grinding typically happens right after the root pass weld is completed, which means the weld can still be very hot. Look for a grinding wheel designed to break down on hot welds, which reduces wheel chatter and glazing. Foundry applications are also examples of very specific applications that require wheels designed for that work. Grinding in a foundry often involves working with hard-to-grind materials using powerful tools, so it requires a wheel that holds up to heavy pressure and higher torque to avoid premature edge breakage. In addition, to avoid contaminating materials like aluminum and stainless steel during grinding, choose contaminant-free wheels designed specifically for those materials. Aluminum is a softer metal with a lower melting point than steel, so use a wheel specifically formulated to break down and not load up with aluminum material to maintain higher productivity.

Getting the Most Out of Grinding Wheels

Making a demanding job like grinding as safe, comfortable, and productive as possible involves attention to several factors, including product selection, proper technique, and the needs of the application. Following these best practices can help improve productivity with grinding wheels.

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Fact Sheet

The Unforeseen Costs of Welding and Cutting

One of the most frustrating outcomes of a job occurs when the costs have been estimated, the order has been received, and the product has been built only to have the cost of the job ultimately exceed the estimate. This is especially frustrating when no clear cause can be assigned to the cost overrun. Often the problem results from failing to identify all the factors affecting cost, especially those that are not direct material or labor costs. Sometimes costs are hidden in operations that were not foreseen. The following explores various factors that can affect cost.

Quality Factors

Quality issues must be recognized as a factor in the management of welding and cutting costs. The cost of quality can be calculated and included in the cost estimate provided that hidden steps or unnecessary operations are identified and evaluated.

However, the cost of quality is not always immediately obvious. It may be found in the scrap bin or in an unexpected repair job that occurs when a workpiece is not cut or welded according to the specifications. It may be hidden in the built-in rework that occurs as a result of having to manufacture weldments that are beyond the performance capabilities of the fabrication or welding equipment.

A typical example of hidden quality costs would be weld joint preparation in which the oxyacetylene cut quality is so poor that extra grinding is required in a rework operation to bring the workpiece into compliance with the dimension, tolerance, or surface finish requirements. Another example would be the welding of a multipass joint in which grinding is required to prevent incomplete fusion. Both the grinding and the metal removal and replacement require additional time and materials to complete the weld.

The production department supervisor is usually aware of these conditions and takes the appropriate corrective action. Nevertheless, the lost time and additional labor and material are not identified and may become a part of regular shop practice without the estimator’s knowledge. If the costs incurred in the additional procedures have not been factored into the cost estimate, the estimate will be low.

Poor workmanship also adversely affects welding costs. The cost of weld repairs can total two to three times that incurred to fabricate the original weld. Not only do repairs involve expenses for time, labor, and materials; they also cause the loss of valuable shop space and delay the overall production schedule. Additionally, poor-quality work may adversely affect the reputation of the manufacturer, which may ultimately be detrimental to future sales.

Overwelding

Overwelding is another unforeseen cost. It typically results from inaccurate cutting and fitting; poor supervision; insufficient training, including on the proper use of measurement devices; or lack of confidence in the strength of the weld as specified. Two joint configurations that often result in overwelding are complete or partial joint penetration welds in T-joints produced in the horizontal position and butt joints fabricated between plates of unequal thickness.

Overwelding significantly contributes to excessive welding cost. As an example, the increase in weld cross section as a result of overwelding is shown in Fig. 1. Overwelding also increases arc time and introduces opportunities for unnecessary defects that could have been prevented by stricter adherence to the weld size called for on the print.

![Fig. 1 — Effect of overwelding on a weld cross section.](image)

A DRIVING FORCE FOR WELDING EDUCATION AND CAREERS

The AWS Careers in Welding Trailer tour continues with upcoming stops at:

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We hope to see you there!

Check out the entire 2023 Careers in Welding Mobile Exhibit schedule at [aws.org/virtualtrailer](http://aws.org/virtualtrailer)