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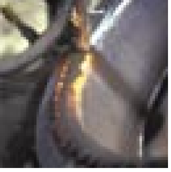
Diamond Tools

ULTRASONIC MACHINING
REVOLUTION IN THE MAKING

DO IT ONSITE
by John Sauer and Ray Homan

ALSO INSIDE:

THE BLACK MAGIC OF BENDING STAINLESS
POROSITY IN ALUMINUM WELDING
WESTEC
OUTSOURCING MAINTENANCE



DO IT ONSITE

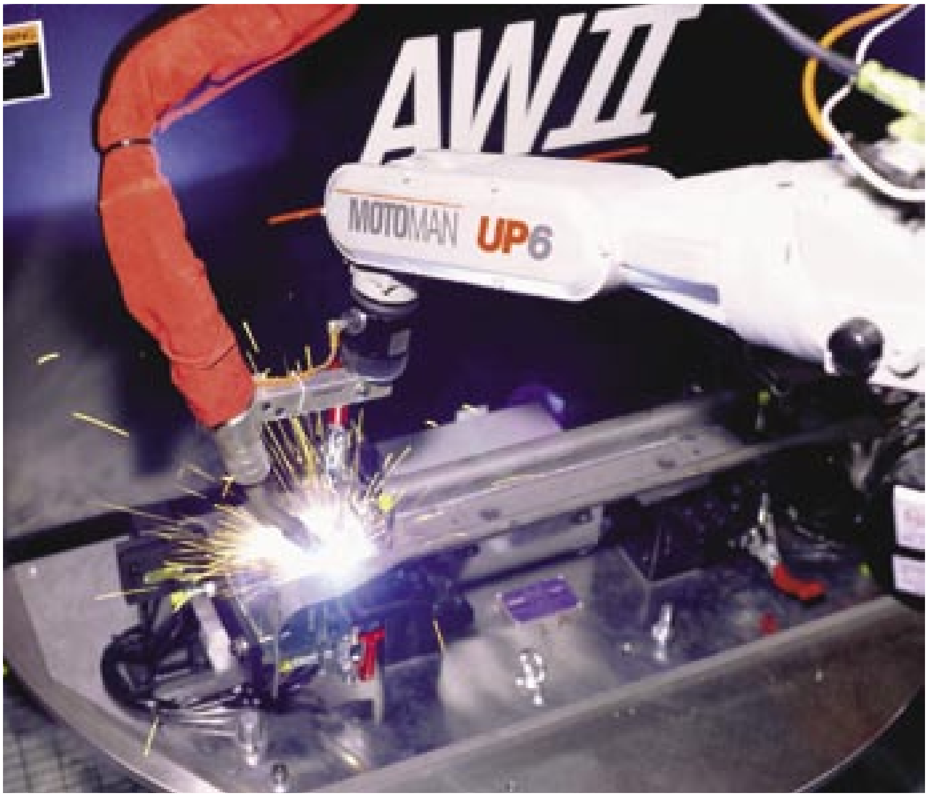


Photo courtesy of Motoman, Inc.

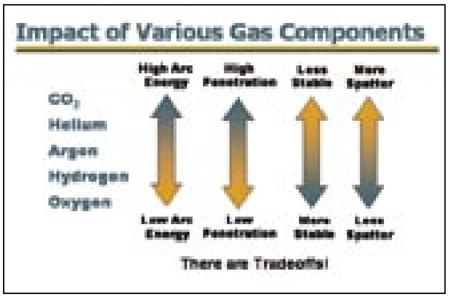


Figure 1. Effects of Gas Components

WELDING ROBOTS AND FIXED AUTOMATION INCREASE PRODUCTION – WHICH IN TURN CONSUMES MORE GAS AND WIRE, ADDS CONSUMABLE COSTS AND INCREASES THE LABOR SPENT CHANGING AND STORING DEPLETED CYLINDERS. UNLESS THESE SUPPLY CHAIN ISSUES ARE SOLVED, AUTOMATION MAY UNDERCUT THE VERY PRODUCTIVITY IT SOUGHT TO GAIN. WHAT'S THE ANSWER?

John Sauer and Ray Homan, Airgas, Inc.

That question has many shops reevaluating their combinations of shielding gas and modes of delivery. Onsite blending has emerged as an effective way of delivering large volumes of precisely-blended gas to support increased production. Consider these areas to decide whether onsite blending is for you:

SHIELDING GAS

Shielding gases protect welds from atmospheric contamination. A great variety of mixes all generally contain two or three of the following gases: argon, carbon dioxide, helium, oxygen and hydrogen. Each blend has different characteristics that impact the weld. Blends of argon, carbon dioxide and helium are formulated particularly for faster travel speeds. Other gas properties affect weld penetration, bead shape and spatter. Figure 1 shows the relative effects of different gases in the mix:

Optimizing the shielding gas for the operation is particularly important when automating. Certain shielding gases can increase travel speed up to 30 percent – a productivity gain ideally suited for a robot because manual welders cannot match this consistently. Welding thin-gauge steel requires a low-energy tri-mix for a shorter arc that reduces burn-through. TIG welding needs a shielding gas that is effective on aluminum or stainless steel. A shielding gas should increase productivity and ensure a stable weld without requiring excessive post-weld cleanup.

MODES OF DELIVERY

How a shielding gas is delivered is as important as the nature of the mixture. Gas is delivered to the site either premixed in cylinders or blended onsite from component gases. The mode of delivery depends upon the volume of gas required. A rule of thumb is that one dewar (liquid cylinder) equals 15 cylinders of compressed gas. Plants consuming three or more dewars per month should consider MicroBulk delivery. Shops requiring 50,000 SCF or more of gas per month are good candidates for bulk delivery.

Premixed cylinders do not require onsite mixing, but they are relatively inefficient in supplying gas to a busy or heavily automated shop. Changing out a depleted cylinder averages 25 minutes – idling production and adding labor costs. 4.5-ft tall, 200-lb cylinders add logistical and safety issues that can complicate daily operations. Cylinders also tend to waste gas, since most return to the supplier with up to 20 percent residual product – adding procurement costs.

Cylinders sometimes contain contaminants – such as moisture, oxygen or hydrocarbons – which can make the weld porous or unstable. Obtaining product from a supplier using the proper controls to prevent contamination, with a track record of providing clean product, is crucial. When using a tri-mix gas, use a premixed cylinder with a "dip-tube" to ensure the consistency of the mix.

Depending on plant needs, onsite blending is generally more efficient in supplying shielding gas. The component gases are delivered and mixed in a gas blender before being piped to the individual welding stations. There are three common modes of delivering gases:

- Dewars
- MicroBulk tanks
- Bulk tanks

Dewars are an entry point into onsite blending. They hold many times the amount of gas in a cylinder because liquefied gas is more compact. Dewars reduce storage and logistics problems and cut down handling time.

Companies using larger volumes of gas should consider MicroBulk or bulk systems that eliminate the hassles of ordering, storage and handling concerns of cylinders altogether. Bulk or MicroBulk systems can save on monthly purchases and eliminate residual returns. Figure 2 compares the costs of cylinders to MicroBulk.

GAS BLENDERS

A gas blender provides a consistent shielding gas mixture across a wide variety of flow rates. Two types of gas blenders are solenoid-based systems and fixed-control, relay-based systems. (See figures 3 & 4).

Solenoid-based systems use regulators to accurately control the pressure, individual solenoid valves, and fixed or variable orifices that meter the component gases at a specified pressure into a mixing tank, which then supplies the gas to the individual stations. These systems generally provide a mix accurate to ±10 percent of the minor gas concentration within a given range.

A solenoid-based system requires regular monitoring with a gas analyzer to ensure the blend is correct. For example, a shielding gas may be specified at 80 percent argon/20 percent carbon dioxide. But if the controls are improperly set, the blend may be 85/15 or 75/25. If one component gas runs low, the blender can generate an out-of-specification blend. In both cases the imbalance may not be noticed until it affects the travel speed and weld quality. A welding engineer typically checks blender output on a weekly or monthly basis to minimize this possibility.

These complex systems use many moving parts – regulators, needle valves, pressure sensors, solenoids – that tend to break down and idle production until the blender is repaired or alternate systems are brought on-line.

Fixed-control systems are pre-set by the manufacturer for consistent output. They use a series of relays and a sintered element to balance the pressure of the component gases for a precise mixture that is accurate across a wide flow range of 2- to 4,000-SCFH.

An advantage of using this system is that when one component gas runs low, the overall gas output decreases. When the component runs out, the machine shuts off completely. This prevents an imbalanced shielding gas from being sent out to the stations and signals the time to replenish the component gas.

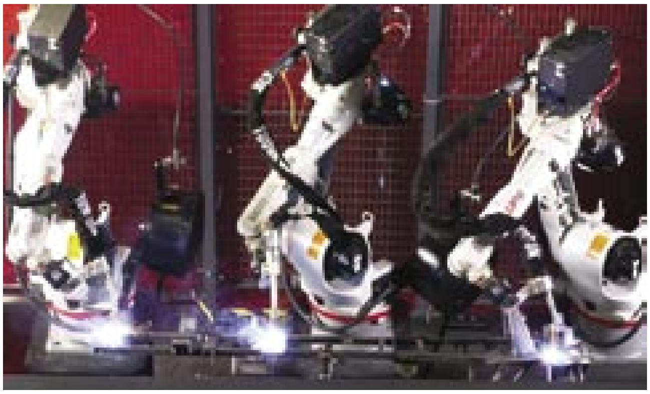


Photo courtesy of Motoman, Inc.

The High Five

Five common problems can be your biggest barriers to welding productivity. Correcting them can have a major impact on your bottom line:

Overwelding

The tendency to overweld can result from slow travel speeds, using too little amperage or having the wrong gun angle. It reduces productivity, increases gas and wire consumption, and often requires post-weld cleanup.

Insufficient Gas Delivery or Using the Wrong Blend

Busy operations may spend too much time transporting cylinders. They can save labor with an onsite blending system. Problems in delivering gas to the stations can also impair operations. Crimps in the line, leaks or bad regulators can restrict the gas flow and slow down production. Suboptimal blends are a problem. For example, replacing C25 (75 percent argon/25 percent carbon dioxide) with a low-energy, three-part mix on thinner-gauge steel could reduce burn-through.

Equipment Calibration

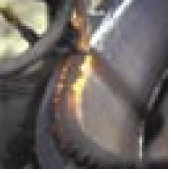
Imagine the gas specification calling for 80 percent argon and 20 percent carbon dioxide. What happens if the blender is actually set for 98 percent argon? Or what if the welders' drop/workstation regulators should be set at 30-SCFH, but are actually releasing higher flows? Product is wasted, and travel speed and weld quality are affected. Analyze gas output regularly to identify these problems.

No Communication of Welding Standards

Does your operator/welder know what a specification calling for a 1/4-in fillet-weld means? The welder might actually be laying a 5/16-in fillet-weld, using extra filler metal, gas and electricity, plus reducing his output. Quality control, training and follow-up are keys.

Station Set-up

Though welding station configuration is typically addressed when automation is first installed, benefits arise from re-examining both automated and manual configurations. Each welder probably has a preferred set-up – but is his set-up the most efficient method? Does he reach around obstacles? Are the parts he is welding not positioned properly? A manual welder averages 20 percent arc-on-time under normal conditions. What happens if he changes position frequently or holds the gun far away from the part because the fixture is wrong?
Is there a fan in his work area? If so, check the angle of the airflow. It might blow the shielding gas away, allowing air to contaminate the welds.



This blender uses no electricity – another cost savings. The system is highly durable because it uses practically no moving parts, although sometimes contaminants in the gas stream can clog the sintered element and must be removed by the manufacturer– a supplier of clean product is important.

FILLER METALS

Automated stations can consume greater quantities of filler metals as well as gas. Consider the filler metal being used. Different shielding gases may require different types of filler metal for the application. For example, certain gas tri-mixes work well with different sizes and types of solid, flux core and metal core wires. Larger diameter wire is incrementally less expensive than smaller diameter wire. To compensate for the greater quantity of wire used, shops might consider switching from spools to drums for bulk purchases that save time changing wire spools. This may eliminate 12 wire spool changes.

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MicroBulk Saves on Monthly Gas Purchases

Keith Huber, Inc. (Gulfport, MS) manufactures ASME vessels and used approximately 45 single cylinders of C25 (75 percent argon/25 percent carbon dioxide) per month. Welders were responsible for disconnecting the depleted cylinders, rolling them to the empty bin, and bringing full cylinders back to their work site. This costs hours, consumes space and creates safety concerns. Adding an Airgas MicroBulk system and using an existing gas pipe, the plant saved $1,000 per month in gas costs alone. It eliminated the labor needed for cylinder handling, improved the appearance and safety of the plant – and helped morale. The increase in gas volume meets plant demand and makes it possible to easily add capacity.

Figure 2. Switching Modes of Delivery Can Save Money

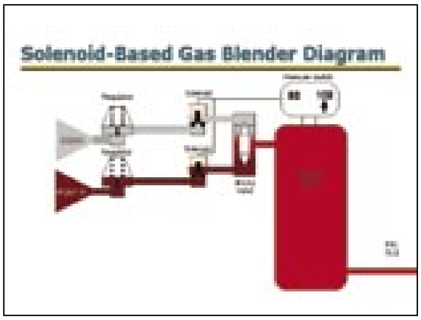

Figure 3. Schematic of a Solenoid-based Blender

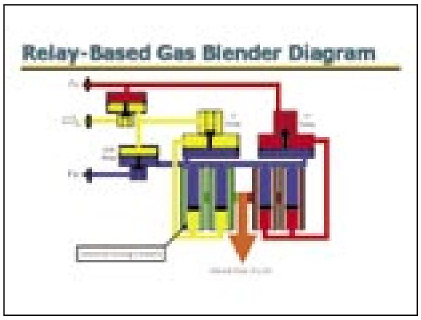

Figure 4. Schematic of a Relay-based Blender

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