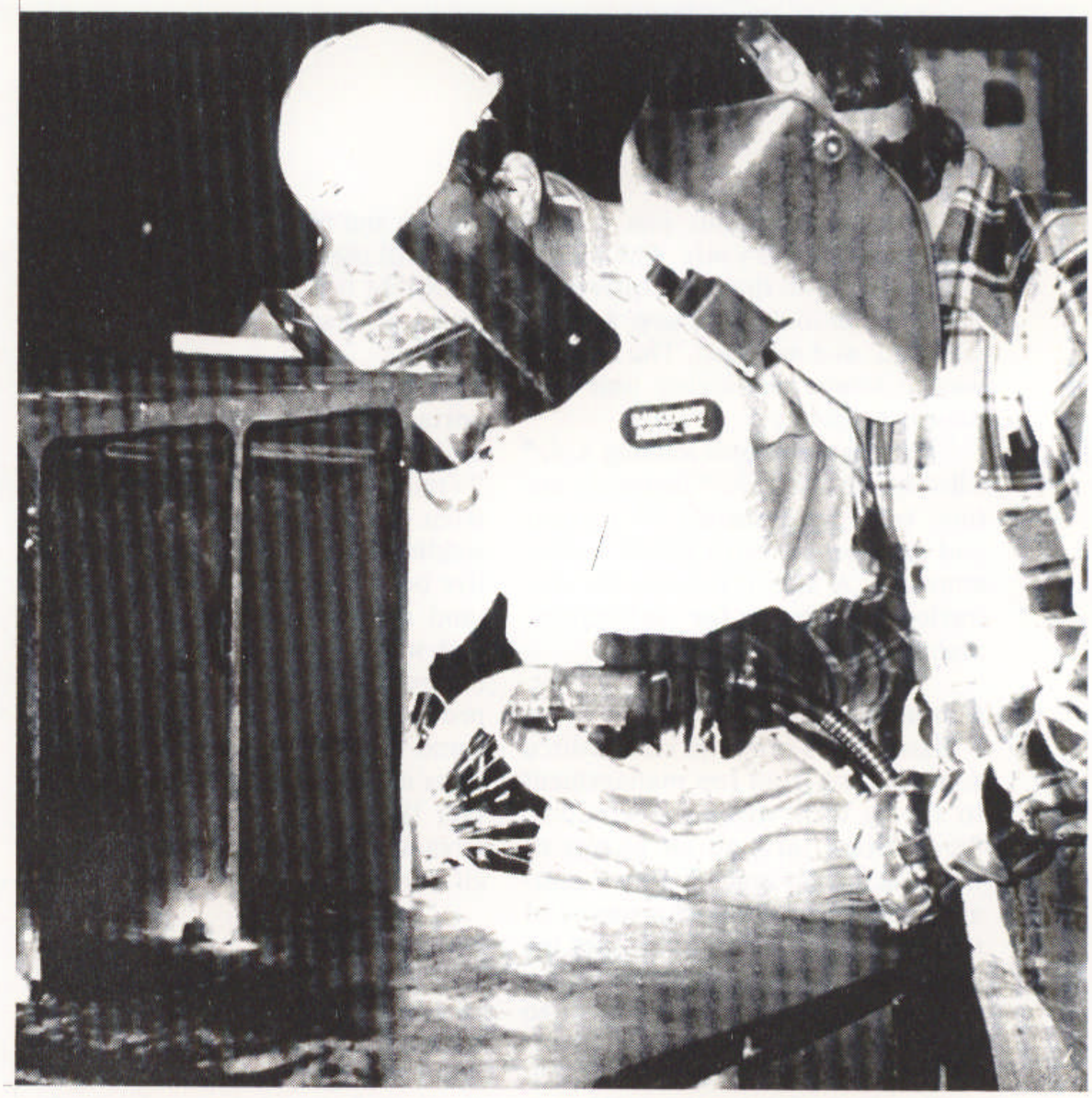
Welcome to 20th-century welding

A new emphasis on training and breaking down the barriers between design and manufacturing can help welding make big contributions to manufacturing profitability.



Welding is one of the most lucrative, yet untapped, profit centers in industry today, says Jack Barckhoff, president, Barckhoff and Associates Inc, Minneapolis, MN, a welding consultant and training firm. He's found that training and motivation, not capital investment, are more often the keys to major improvement at minimal cost. "Our experience shows that productivity improvements of 20 to 40 percent are possible in the average welding operation, with no capital investment. We can document potential savings of $10,000 to $15,000 per welder, per year."

Yet most managers view welding as an uncontrollable cost center. He notes that close to 50 percent of US welding is still stick welding, based on figures for consumables. "Thirty years ago, I was told that in five to ten years, we'd see big improvements in welding automation—that 75 percent of users would be using semiautomatic or fully automatic processes. It's still not there, and it won't be any time soon. Welding is just a dirty business that management leaves to the welders, so it remains archaic. Thus, our task is to help industry realize welding can be an engineering science with welder skill and some art involved—rather than all art, as too many people see it now."

By Eugene E Sprow
Special Projects Editor

Hands off the welders

Typically, management relies on the welders and supervisors for guidance on correct welding procedures, achievable productivity, welding costs, and equipment purchases. "Most managers stop managing too far up the ladder," he says. "They feel that as long as the welding arc is on and the weld looks pretty good, everything's fine." Because of a lack of confidence in weld design and process control, the company's designers, manufacturing engineers, and QC people often fail to plan and control their welding operation.

He advocates driving decision making and responsibility to the lowest level possible and having each person manage his own area, inspecting and guaranteeing his own work, based on specific management guidelines: specifications, standards, and procedures.

"In a welding operation, consistent quality is difficult to achieve when the basics are not in place," he advises. "With no meaningful workmanship-performance standards or basic welding understanding in place, the shop floor has no real standards to comply with and will produce poor quality."

This can yield costly product-liability and litigation problems, with skyrocketing insurance rates. However, a sound weld-quality control program can reduce this exposure. The results can be reduced floor-to-floor cycle time and welding costs, including major reductions in: weld-metal volume, arc time per weldment, scrap and rework, work effort, welder fatigue, and delay time.

They recently surveyed a company in Minnesota where stick welding represented 87 percent of their total electrode volume purchased. Changing just 16 welders from stick to semiautomatic welding gained 10,608 hr of available arc time or $176,000 ($11,000 per welder) annually.

Why overspecify?

Too often, the design engineer will overspecify weld sizes to be certain the weld joint will not fail. "The welding supervisor asks for a little bit more than specified," observes Barckhoff, "the welder adds a little bit more to make the supervisor happy and his weld stronger, and

the inspector demands just a little bit more to be extra safe. The welder is often left with the very costly decision of weld-joint type, size, process selection, and methods. The result is wasted hours and higher unit cost than is necessary."

"For example, overwelding a $\frac{3}{16}$" fillet by an extra $\frac{1}{16}$" increases arc time (and weld metal) 78 percent and can cost an extra $8400/welder annually. A side effect can be distortion problems for subsequent manufacturing operations."

Commitment at the top

Barckhoff's program starts with a commitment from top management to survey their welding operations, from design through all phases of manufacturing and quality assurance. "We first conduct a survey of the welding operation to identify the improvement opportunities. Second, we work with management to establish goals and specific plans. Third, management assigns responsibility for applying the total program, with each of the four functions participating—design, manufacturing/industrial engineering, production, and quality assurance.

"We use these six management control steps: 1) data gathering, 2) management planning and goal setting, 3) training, 4) implementation, 5) monitoring, auditing, and inspection, 6) management reporting. In this manner, you can marry the science and technology of welding to sound management principles."

Try putting the welder at the top of the company organizational chart, instead of the bottom, he suggests. "This symbolizes a serving staff and management team where the job of each is to provide every element on a timely basis to make the welder successful."

Everybody needs educating

Training is the key missing ingredient, Barckhoff reports. "Nearly every company I've seen needs some form of training, tailored to their specific needs. For a large company, the first step is a two-week training program on-site, training a core group of people from the basic engineering and manufacturing functions who will then train others and be responsible for carrying out the projects generated from the initial survey."

Education and training yields important dividends in better mutual understanding, he has found. "Training that addresses people from all the functions that affect welding, has been especially effective because people begin to understand the various operations better and why certain variables must be controlled. Welder attitudes are improved because they can now understand why certain materials and designs are specified, and how important their work is to others downstream who need parts held to specific tolerances."

Standards first

The key is to build fundamentals first, before even thinking about automation and robotics. "If they don't have good standards or specifications for weld sizes or joints, for example (and most companies don't), these must be established.

"Sure, most companies will say they have standards. They just hand the shop a huge AWS standards manual and say 'Weld to American Welding Society D1.1.' Welders can't really interpret that, and neither can supervisors. So, a judging contest develops between the inspector, welder, supervisor, and engineer, and everyone plays it safe by overwelding.

"Once workmanship standards and procedures, as well as quantity (time) standards are established, designers can tolerance welds tighter. When all these things are in position, a company is ready to move into automation, but not before.

"With the cost of one robot cell around $250,000, it's often too much of a jump, too quick, for a lot of companies. They need it, but the first step is to clean up their manual welding act—nail down the basics. Do for the man what they would do for the robot. When you've got that down—part-input flow, specifications, processes, and fixturing—then get the robot."

Savings

Welding intensity, regardless of company size, is the key to deciding who needs this kind of help. "Even in a shop with only three people welding out of a shop total of 20 workers," Jack explains, "welding will be significant to the total profit picture. So whether the company is small, medium, or large, it can profit from our methods if the contribution welding makes to total potential profit is significant."

Savings extremes run from a minimum of $5000/welder for the above average shop to as much as $30,000/welder for the horror-story situation. More typically, savings average $10,000 to $15,000/station, with no capital investment. With automation and robotics, of course, the savings can be much more and the number of welders will probably change.

"What you're doing is taking that jagged cost/time curve—all the erratic moves of a manual process out of control—and smoothing them down to a steady ripple, reaching a more stable plateau of basic welding-station costs for a process under control. Then, to bring that curve down further, you apply automation."

The average savings of $10,000-$15,000/yr/welder is based on boosting arc time to 40 percent using the semiautomatic process, with labor at $25/hr, a 6.8-hr day (85 percent work efficiency), and a 240-day work year. That's compared to prior arc times ranging from 10 percent to 30 percent.

What's it all cost? Typical cost of the Barckhoff program is generally less than 10 percent of the first year's savings. So the payback is very quick, although there are obvious internal costs for employee time spent for planning, training, standards development, and implementation. "We don't deal in hardware, or even pick suppliers," Jack adds. "We just recommend by AWS specifications or machine specs. We have no commercial affiliations."

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