Training trims welding waste

Welders learn from fellow employees to make higher-quality welds, to avoid overwelding, and to eliminate excessive arc-on time.

By Ty Jones

Two manufacturers of large weldments recently instituted training programs that help workers to set and achieve goals for improvement in weld quality and output. The firms use a program based on in-house training as developed by Jack Barckhoff, Barckhoff and Associates, Inc., Minneapolis, Minn. The results: important gains in quality and productivity at the Franklin (Pa.) plant of Joy Machinery Co., and at the 12 plants of Quality Service Railcar Repair Corp., a subsidiary of General Electric Railcar Services Corp.

The keystone of the programs was realization by top management that welding operations were costly and inefficient and that, with clear management support, the waste and inefficiency were correctable. Waste in welding resulted from lack of controls: supervisors gave little guidance, so each welder selected process parameters and welding techniques that he deemed best.

Charting the course

The two companies called in Barckhoff, an outside consultant unfettered by company tradition and practice, to focus on solutions and to initiate an improvement program. Barckhoff identified trouble spots, prioritized them, and proposed an in-house training program to correct welding deficiencies.

- Excessive weldmetal volume, the result of over-design by conservative engineers and addition of 'insurance' beads by welders.
- Excessive arc-on time per weldment, the result of excessive weld metal deposition or of use of undersize electrodes or improper welding parameters.
- Scrapping or reworking of parts improperly welded due to poor technique or poor process control.
- Long waits between welding steps, often caused by handling and positioning delays.

Management shows support

Joy set up a welder training center and released employees from production to run the program. Its announced goal was $1,000,000 annual weld-cost reduction, including $223,000 yearly in these areas:

- $111,000 through specification and enforcement of process parameters for flux-cored-arc welding. Welding engineers and technicians would audit settings to be sure that welders used the specified parameters.
- $47,000 through specification of process parameters for gas-metal-arc welding; auditing by engineers and technicians of settings used; and use of manifolded pre-mixed shielding gases, also audited by engineers and technicians. This would supersede selection of parameters and gas by welders.
- $65,000 through reduced arc-on time, resulting from precise weld sizing and consequent reduction in overwelding.

At Quality Service Railcar Repair, management prepared a booklet that set long-range goals for cost reduction and quality improvement at its 12 plants. Welding headed the list with a savings target of $816,000.

- $27,540 through installation of positive-grip ground clamps, replacing spring-type ground clamps and cables that wedged against work, often leading to poor grounding and flawed welds.
- $486,000 through provision of wire-feed equipment to all welders, and encouraging use of mig welding where possible, in place of 100-percent stick welding.
- $85,700 through stocking of 3/16-inch-diameter stick electrodes. Welders trained to use the larger stick whenever possible rather than using 1/8-inch-diameter electrodes exclusively.
- $27,540 through storage of E7018 electrodes in 300-F ovens

overnight rather than storing electrodes in any available container, a practice which led to welds requiring repair.

- $134,460 through use of a weld-mockup standard for weld size and quality appearance.
- $27,540 through scheduled maintenance of welding machines and cables including periodic calibration of gages on welding machines; use of guidelines for selection of cable size.
- $27,540 through reduced fitup gaps and tolerances, reducing the amount of deposited weld metal.

A key factor in selling the program at QSR was the message, communicated to all levels in all plants, that smaller shops operating at lower costs were bidding in competition with QSR. Employees understood that if costs at QSR did not come down, neither would prices, and jobs would disappear.

Staffing and implementing

For in-house trainers, both companies used staff methods and manufacturing engineers, welding engineers, and welders. Barckhoff tutored the trainers, who followed through with lectures and demonstrations for fellow workers. Welders learned how to weld consistently and efficiently. Design engineers learned to select and specify the best joint for each purpose.

Important training tools in the QSR program are 12 mockups of each weld used in repair or fabrication of railcars. Fabricating the mockups at QSR headquarters in Chicago, the company sent one to each plant. There, trainers use them to show correct size, shape, and surface appearance of each joint, shielded-metal- or gas-metal-arc welded. The mockup gives welders and inspectors a visual standard by which to judge the work.

Tracking the changes

QSR and Joy managers monitor programs to assure that poor habits don't creep back, and that good habits become entrenched. Publicized on-going support of the programs by management makes the changes permanent.

Joy has focused on correcting inefficiencies part by part, emphasizing use of proper technique, weld size, and process control. Rather than auditing cost savings or establishing specific savings targets for individual parts, the company relies on monitoring of welders by supervisors and instructors.

Monthly reporting by each QSR plant of actual versus planned savings per welder in seven areas is summarized and forwarded to the vice president. The plan focuses primarily on providing better equipment for welding, secondarily on better methods or techniques. Bill Markham, QSR industrial engineer, the man who summarizes plant reports, says that welding cost improvement programs have stayed on target. ■

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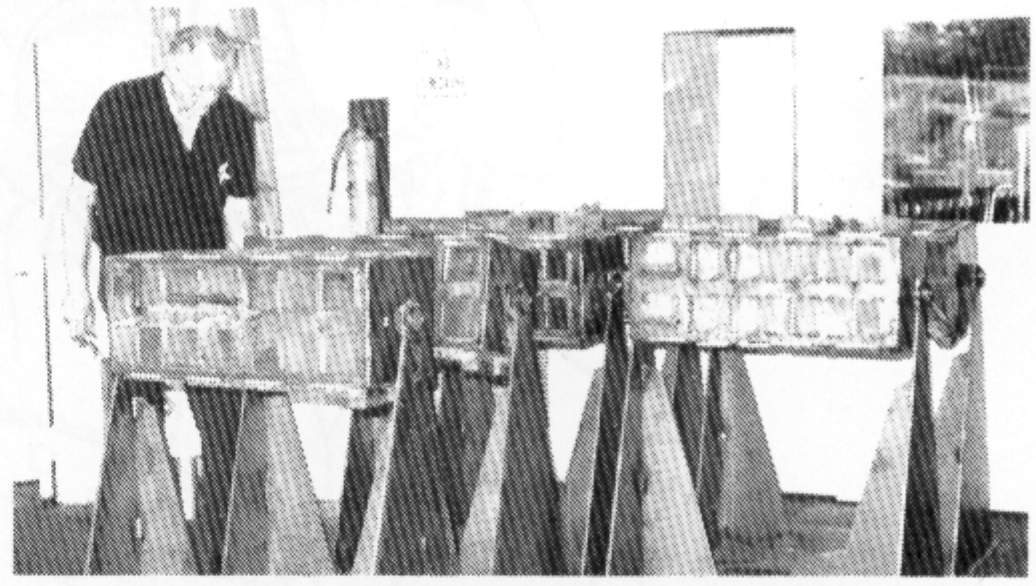
MOCKUP DISPLAYS WELD QUALITY STANDARDS

A mockup at each plant of Quality Service Railcar Repair displays standard welds, showing welders and inspectors size, shape, and appearance of welds specified on shop drawings. The mockup is a rectangular box 32 inches long and 12 by 12 inches cross section. Mounted on a stand to pivot about its longitudinal axis, the mockup presents on its four faces sample lap, butt, fillet, and T-joints made by gas-metal-arc and shielded-metal-arc welding. Base material is mild steel 1/4 to 1 inch thick; welds are made in flat, horizontal, vertical up, vertical down, and overhead positions.



WELDS SHOWN ON FACES OF MOCKUP

Display face	Joint type	Weld[a]		Material thickness in.	Weld location
		Position	Size		
1	Lap	Overhead	5/8-in. fillet	1	Center plates
	Butt	Vert. up	3/4-in.	3/4	Sill splices
		Flat			
	Butt	Vert. up	1/2 in.	1/2	Tank inserts
2	Butt	Flat	1/2 in × 30°		
	Lap	Vert. down	3/16 in.	3/16	Side sheets and side plates
		Horizontal			
		Overhead			
3	Butt	Vert. down	3/16 in.	3/16	Splices in side sheets and hopper slopes
		Overhead			
	Butt	Horizontal			
	Lap	Overhead	3/16 in.	3/16	Jacket repairs
		Vert. down			
		Horizontal			
4	T	Overhead	1/4-in. fillet	1/4	Brackets and supports
		Vert. down			
		Horizontal			
		Horizontal			

a. All welds are made by gas-metal-arc and shielded-metal-arc welding and are 4 inches long except the last, an intermittent fillet, 2 inches on 6-inch centers, on a 12-inch-long part, made using shielded-metal-arc welding.