
Berkeley Pioneers High Performance Automated Welding

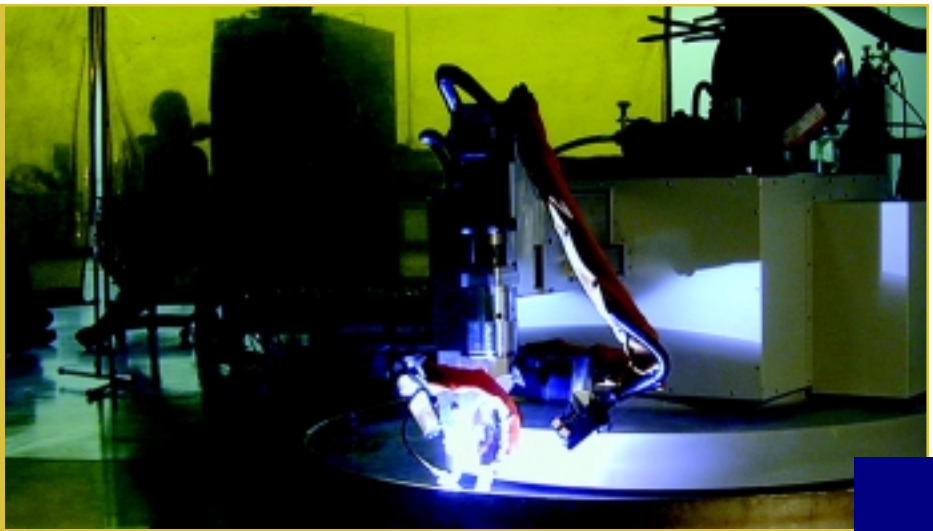
for the Nuclear Power Industry

by mario lento

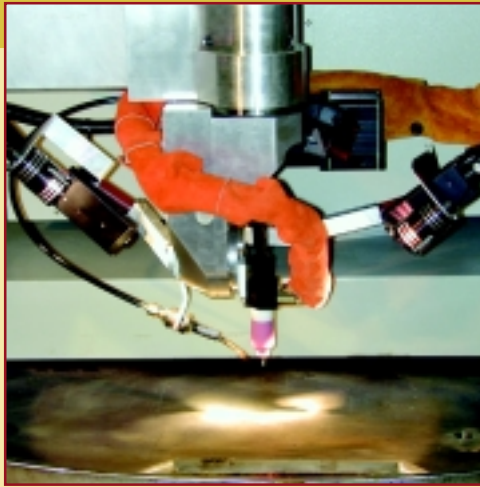
photography by matt sagues

In 1995, working closely with nuclear welding experts, Berkeley Process Control (Berkeley) revolutionized automated welding for the nuclear energy industry with the introduction of its Automated Welding System (AWS). The number one goal of developing this machine was to minimize worker exposure during the meticulous welding process required by the Nuclear Regulatory Commission (NRC).

**Berkeley's Advanced
Welding System —
the only welder
specifically designed
to weld spent
nuclear fuel
canisters
remotely.**



project goals



Minimize exposure of workers to radiation.

Meet all regulations as mandated by the NRC.

Calculate and weld complex geometries around the primary welds and the keyway.

Provide the operator with all of the weld parameters in real-time – intuitively.

Control directly the welding power supply, wire feed and all motion axes to position the torch precisely during welding.

Design the system to accommodate a plasma torch to open the canister as required by the NRC.

industry's lack of reliable automated welding systems

Typical canister welding systems have been developed by companies that specialize solely in welding. However, because of their limited experience with complex machine control, the resulting products have often been awkward and unreliable, plus they require a high level of operator expertise. Berkeley has taken the opposite approach — they have married their world-class controls expertise to high-quality commercial welding equipment. They partnered with welding

experts to create the finest automated canister welding system available.

To accomplish this, Berkeley began with the world's highest performance 64-bit RISC motion-and-machine control system. Berkeley's 8-axis MachineWorks® tx system holds all values and parameters under its control with 15 decimal places of accuracy as it welds six-foot diameter lids onto various canisters of spent nuclear fuel. The integrated controller runs all six motion axes, I/Os, recipe scheduling, and operator interface functions. Choosing to depart from traditional control systems, which attempt to marry a number of disparate control subsystems together, provided the basis for this extremely successful welding tool.

repeatable weld quality

The AWS's precise control of all user-defined welding parameters makes the welding process completely repeatable. Some of these parameters include:

- w Weld start sequence (pre-purge time, current ramp-up, ramp-down, and post-purge time)
- w Wire feed schedule (start feed delay, stop feed delay, rollback distance, primary and secondary speeds, duty cycle, synchronization with oscillation or current)
- w Oscillation (excursion time, dwell, width, synchronization with current)

features and benefits of Berkeley's automated welding system

reduced occupational exposure and welding time

- w The Berkeley AWS comes with cable lengths that allow the operator to remotely weld up to 100 feet away from the canister.
- w The pre-programmed operations (inner cover, outer cover and qualification welding), welding steps (tack welds, root welds and circumference welds) and extreme reliability, combine to facilitate remote operation, greatly reducing occupational exposures.
- w The AWS allows the user to optimize the heat input consistently so that the correct amount of shrinkage of the canister shell is consistent - eliminating the need to rework cover plates, while minimizing welding time and increasing weld integrity.
- w Utilities that have switched to Berkeley's welder have recorded exposure reductions of more than 50%.

For example, the AWS control system synchronizes the pulsing of the primary and background current with the actual position of the welding torch, while it controls the wire feed-rate. This is especially noteworthy since the Berkeley AWS allows the user to define the amount of oscillation of the weld path. By oscillating the torch, the AWS can bridge the weld gap and therefore cover a wider weld area than non-oscillating systems. By coordinating the pulses of current with the real-time position of the torch head, the operator has ultimate flexibility in determining where the heat goes and thus the quality of the welds.

To maintain the precise arc-voltage, the AWS system automatically modulates the height of torch tip based on real-time process feedback.

The AWS allows for a single point of control for welding, wire-feed and torch actuation via a single interface, making operation and learning of the tool very intuitive.



**The Berkeley AWS
Control Console —
a user-friendly interface.**

**On-the-fly operator control
of weld quality**

In addition to setting the industry standard for reliability, the Berkeley AWS has gained a reputation of being “user friendly.”

The control console provides a front-view and rear-view video monitor attached to two cameras. The operator can monitor the welding process, which requires clear observation of the weld puddle.

The Berkeley AWS allows the operator to easily change any weld parameter on the fly during operation. The recipe creation is completely definable by the user as well.

**Only welder specifically designed for
remote, intuitive canister welding**

The Berkeley AWS is the only welder in the industry completely designed specifically to weld remotely and intuitively canisters of spent nuclear fuel. Success has been based on the design being performed by control experts in conjunction with nuclear canister welding experts.

The AWS uses the Gas Tungsten Arc Welding (GTAW) process, which provides highest quality welds.

**Industry’s most reliable,
user-friendly welder**

Berkeley’s welder is known to be the most reliable in the industry—period. Since the first canister was sealed in 1995, every Berkeley AWS built is still in production. In fact, after using one of the original six year old Berkeley AWS units, a customer recently decided to purchase one for the Pennsylvania Power & Light utility. This client was so impressed with the original welding system that they specified its new order be identical to the original welder manufactured in 1995.

**You can ask around — industry experts
can vouch for the Berkeley welder**

Berkeley is proud of the industry respect its AWS has earned. For a list of satisfied customers, contact Mario Lento at (510)307-3346 or email mariol@berkeleyprocess.com.

**Berkeley AWS delivers immediately —
with a long-term solution**

Plants that have taken ownership of the Berkeley AWS have solved a problem for years to come. By eliminating the need to go outside for the welding services, AWS frees plants from the expensive and frustrating cycle of solving the problem again and again.