

Local Company Makes Good (Magnets)

by Leila Belkora, Office of Public Affairs

For Gary Durling and Mike Yeoward, co-owners of a metal fabrication business in Rock Falls, Illinois, winning a Fermilab contract proved both more challenging and more rewarding than they expected. In the three years that SVF Incorporated has been making half-cores—the steel innards of dipole magnets for Fermilab’s new Main Injector particle accelerator—Durling and Yeoward have learned to live up to extremely tight specifications and demands for exceptional quality assurance. In reorganizing the company to meet the challenge, they’ve improved their bottom line. “We have the feeling now that we’re running at the level that we always thought we could reach. The ability to supply Fermilab is an attractive thing to have in our dossier,” says Durling.

The parts they make confine and shape the magnetic field that steers high-energy particles around the circular accelerator. Dipole magnets destined for Fermilab’s Main Injector consist of a half-core on the top, an identical one on the bottom, and coils in the middle; the parts fit together like a sandwich in which the coils are the ham. The half-cores are 20 feet long, and they curve a little along their length, to match the curved path that the beam will follow in the accelerator.

SVF’s crew of half-core builders includes production and procurement managers, two quality control specialists, two “lead men” supervising work on the floor, six technicians, two certified welders from a pool of eight employed at the company, and a truck driver to haul the raw materials from Fermilab and return the finished product. The technicians perform a variety of tasks including mixing epoxy, coating steel plates or laminations with epoxy (“wet laying”), stacking laminations, using a curing oven, and operating a “grit blast” to clean excess epoxy off the stacked laminations.

The half-cores contain about 4,000 thin steel laminations, which another contractor has stamped from steel sheets so that the shape of the laminations is just right to make the correct magnetic field. The challenge for SVF employees is to stack the laminations so that the 20-foot-long half-cores are within 30/1000ths of an inch of the specified length, the bottom and top faces of the half-cores are



Above, Mike Yeoward (left) and Gary Durling in their Rock Falls factory.

At right, the half-core building crew, left to right: Dan George, Gary Durling, Mike Beyer, Jason Burge, Mike Yeoward, Jason Mammosser, Mike Thorne, Cralles Borden, Tim Hoagland, Richard Spohn, Art Meighan, Tom Goss.



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~ Gary Durling, co-owner of SVF Incorporated

flat to within 5/1000ths of an inch, and the whole assembly follows the so-called sagitta bar that gives each half-core its gentle curve. “The level of quality control is higher than I’ve dealt with in my metal fabrication career,” said Durling, who has been in the business for about 30 years. To stack the laminations with the tightest possible fit, SVF workers follow a “recipe” provided by Fermilab that accounts for small variations in the lamination dimensions.

The process of putting a half-core together begins with end packs. “The end packs really serve as ‘bookends,’” explained Gale Pewitt, project manager for Main Injector magnets at Fermilab’s Technical Division. Once the end packs have cured, technicians bring them to the central work area and lay the first one on a special stacking table. Starting at one end, technicians stack laminations behind the end pack, apply a clamp, and stack again. They weld top and side plates to the “bookends” and, intermittently, along the length of the half-core. Epoxy ensures that the end packs hold the right shape under pressure.

“If the end packs weren’t glued, we would have to machine a similar shape from a solid piece of iron,” said Pewitt.

At every step, inspectors check that the flatness matches the blueprint specifications and record the results of tests in a notebook, or *Traveler*, assigned to each fabrication element. Durling said SVF employees adopted Fermilab’s quality assurance program to help them meet the Laboratory’s stringent requirements, and that the program boosted SVF’s productivity overall. “We used to tolerate 25 to 30 percent ‘re-work’ jobs,” said Durling. “Quality was important to us, but it was hard to put a handle on it. We figured there’s 10,000 ways to make something wrong, and only one way to make it right. In the process of dealing with the Fermilab contract I was lifted to a level of quality I did not have practice with before, and that has totally boiled over into other areas. Our rework rate is now something like 5 percent.”

Durling credits Fermilab Project Engineer Nelson Chester and Material Control Group Head Gregg Kobliska with helping him along the learning curve.



Above, Richard Spohn lowers a group of laminations onto the table to add to the stack (foreground). Each lamination has notches stamped out of the bottom edge, where the magnetic coils will fit.

At left, Spohn uses a feeler gauge to test the flatness of the bottom edge of the stack.

“We had problems to overcome, but I had regular contact with Fermilab, and if I couldn’t figure it out, they helped me through the problem,” he said.

Pewitt has nothing but praise for SVF, saying, “They’ve done a good job of providing a high-quality product.” Durling is ready to take things a step further. “I’m proud of what this company has done. Sometimes we had to be led by the hand a little bit, but we took advantage of Fermilab’s expertise. Now we’re out to attract other aspects of the magnet business.” ■