

MEMCO'S

# Applied ADVANCING YOUR WELDING PERFORMANCE Welding

Issue 3, 2004



## INSIDE THIS ISSUE:

Richard Childress Racing Gives Miller the Checkered Flag.....2

New Bobcat, New Trailblazer Are Fully Enclosed .....6

TIG Welding Repair Extends Tool Life .....8

Pulsed MIG Welder Provides Six-Month ROI .....12

Take the Welder to the Work With Auto-Line Technology .....15

## The Art of Tool and Die Repair: Advice from Five Star Tool Welding

*Auto-Line Capabilities of Dynasty TIG Inverters  
Impress Five Star; Operators also Praise  
Arc Performance of Syncrowave and Maxstar*



# TIG Welding Repair Is Best for Extending Tool Life, Quick Return to Production



“For positive arc starts at low amperages and for welding aluminum, a TIG inverter will provide the best results and better directional control.”

Joe Canfield, president of Five Star Tool Welding, performs micro-welding on a die cast insert for a lock mechanism with the Dynasty 200 AC/DC TIG/Stick inverter. Canfield dials welding power down to 1amp for the delicate repair work he does.

By Brent Williams, product manager, Miller Electric Mfg. Co.

# T

ools and dies have a hard life, and even normal wear takes its toll.

Tooling cracks, material wears away or a screwdriver is used one too many times to pry a part from a die. Soon, tooling no longer functions well or cannot hold the necessary tolerances.

Such problems lead customers to call on Five Star Tool Welding Corp., Butler, Wis. “There aren’t too many tool-and-die welding service houses around—we’re probably one of five in the entire state,” says Joe Canfield, Five Star president and owner. His firm focuses exclusively on tool and die welding, including micro-welding.

Weld repair, notes Canfield, lowers part replacement cost, extends tooling service life and returns tooling to service faster than any other option. Rapid return to service even trumps price as a consideration for metalformers.

“Metalformers and die shops come to us because they don’t want to build a new die. They want it repaired quickly,” Canfield says.

Tool repair also requires highly specialized knowledge—it’s definitely an art. When tool-steel companies produce a new grade of steel, such as the 9V and 10V crucible powdered metals (CPMs) or 300- and 400-series stainless steels, Five Star devises a welding procedure based on consultations with the material producer and its own experience.

Five Star works with all grades of tool materials including H13, S7, D2, A2, all

## Customer Profile

**Name:** Five Star Welding

**Location:** Butler, Wis.

**Web:** [fivestartoolwelding.com](http://fivestartoolwelding.com)

**Year Founded:** 1987

**Number of Employees:** 8

**Featured Products:** Dynasty 200 DX, Big Window Elite, Syncrowave, Aerowave, Maxstar

aluminum-bronze alloys, beryllium-copper alloys, copper, bronze, aluminum, magnesium and zinc. Parts they repair include stamping and forming dies, plastic-injection molds, diecast dies, blow molds, compression/transfer molds, Dynacast and Techmire dies and related components.

### Precision TIG Welds

Five Star almost exclusively uses the TIG process because the operator can observe the area needing repair and adjust the amperage accordingly—down to 1 amp DC or 5 amps AC. Other welding processes do not provide this level of control over heat input or weld-bead width.

“With TIG, we can pinpoint the arc at the area being welded,” says Steve Coleman, Five Star general manager. “We can direct the weld puddle so it doesn’t destroy the surrounding area or require the customer to perform extra machining.”

As an example of pinpoint control, Five Star once received a competitor’s micro-weld sample with a weld bead on

top of the head of an ordinary shirt pin. Coleman placed a new weld bead on top of the competitor’s weld bead and mailed the pin back.

While Coleman performed that feat with a traditional Miller Syncrowave AC/DC TIG power source, Miller’s newest machines feature an advanced squarewave output and use inverter technology. This technology achieves greater penetration, narrows the weld bead, increases travel speeds by as much as 20 percent and may permit using smaller-diameter tungsten to more precisely direct the heat or make a narrower weld bead. It also reduces the size of the etched zone for improved cosmetics and produces a more stable arc and positive arc starts at 5 amps or less.

Most of Five Star’s TIG equipment comes from Miller, including the Dynasty AC/DC TIG inverter featuring Auto-Line technology. Inverter technology does not require continuous high frequency for AC welding, helping eliminate a problem that affected a computer Five Star had used for



*The Dynasty 200’s Auto-Line capabilities enabled Joe Canfield to make this field repair simply by changing from the 460 volt, three-phase plug used in the shop to a 230 volt, single-phase plug.*

## The Power of Blue® PAYOFF



### Miller TIG Welders

Tool and die repair depends on precision TIG welds to breathe new life into tools costing thousands of dollars, and Five Star Tool Welding depends on Miller TIG welders for flawless performance. This includes several Syncrowave AC/DC TIG units, a Maxstar DC TIG inverter and a Dynasty 200 DX AC/DC TIG inverter.

“We can direct the weld puddle so it doesn’t destroy the surrounding area or require the customer to perform extra machining,” says Steve Coleman, Five Star general manager. As an example of pinpoint control Five Star achieves with Miller welders, the company once received from a competitor’s micro-weld sample with a weld bead on top of the head of an ordinary shirt pin. Coleman placed a new weld bead on top of the competitor’s weld bead and mailed the pin back.

For more information:

Circle 7 for Syncrowave Series

Circle 9 for Dynasty 200

Circle 10 for Maxstar Series

Circle 11 for Auto-Line

Visit [MillerWelds.com](http://MillerWelds.com) or  
call **1-800-4-A-MILLER**

accounting. Also, notes Canfield, when wired for 460 V three-phase power, Auto-Line allows the Dynasty to draw just 7 amps at rated output while Five Star's traditional TIG machines draw nearly 100 amps. The low-amp draw reduces utility bills and allows Five Star to add more machines on the same breaker without making changes to primary power.

Canfield also likes Auto-Line's flexibility. It allows using three-phase power in the shop and, simply by changing the plug, using single-phase power for field work. Further, the Dynasty 200 weighs less than 50 lbs. and is smaller than a carry-on suitcase, so it travels to remote job sites, such as when a famous Milwaukee-area sculpture garden needed some repair work done.

### Tips on Tool Weld Repair

Overall, the methods Five Star uses to create a sound TIG weld do not differ greatly from other precision TIG welding operations that use the newest technology and techniques. Operators

*"The arc needs to start instantly and it must start precisely where I direct it."*

strike an arc, establish a weld puddle and add filler metal as necessary. The education section of Miller's Web site, MillerWelds.com, offers a free, downloadable PDF called Guidelines to Gas Tungsten Arc Welding (GTAW) that covers the newest technology (look under "Books & Pamphlets"). For detailed fundamentals, examine the 84-page TIG Handbook (look under "Resources for Sale").

However, some special techniques and cautions are particularly important for tool welding repair. Five Star offers the following advice:

**Always use a gas lens.** This screen inserted inside the cup prevents turbulent gas flow and provides a wider area of shielding-gas coverage. It allows

increased electrode extension, from  $\frac{1}{4}$  to  $\frac{3}{4}$  in. beyond the cup, which reaches into corners and improves weld-area visibility.

Shielding gas should be 100 percent argon for all materials, but thicker sections of aluminum may benefit from a helium/argon mix. Consult with your local welding supply distributor for specific shielding gas information.

**Mind tungsten selection.** Select a 2 percent ceriated tungsten for all ferrous and nonferrous materials. Five Star has experimented with pure, thoriated, zirconiated and ceriated tungstens and has determined that 2 percent ceriated tungsten best maintains a point on the end of the tungsten, provides more consistent arc starts and a narrow arc cone.

Coleman says, "We use 2 percent ceriated in different diameters, larger diameters (typically  $\frac{1}{8}$  in.) for AC welding,  $\frac{3}{32}$  in. for normal welding and  $\frac{1}{16}$  in. or 0.040-in. for microwelding."

**Proper tungsten preparation.** "We have a special sharpener with a diamond wheel that puts a smooth finish on the tip that we grind onto the tungsten," Coleman says. "That ensures an even better start. If the tip has any rough spots, the current will catch that rough spot and carry it somewhere else."

"When I work on aluminum," says Canfield, "I try to sharpen the electrode and place a small land on the end. Otherwise it balls up and wobbles. At high amperage, a wobbling electrode could blast right into the weld and contaminate it."

**Find the right filler.** Matching the filler metal to the base metal seems like a straightforward task: just pick two materials of the same type. However, the parent material's hardness and current tempering state throw a monkey wrench into that equation.



Steve Coleman repairs a damaged insert edge of A2 tool steel. The crack to be repaired is indicated by marker (inset).

“When welding A2 steel,” says Canfield, “we use an M2 rod because it produces a finished weld with a Rockwell hardness of 60 to 62. If we used an A2 rod in its hardened state, the weld would exhibit about a 54 Rockwell. Then customers would have to heat treat the whole piece to obtain the right hardness, which they don’t want to do.”

**Positive arc starts.** Five Star operators value positive arc starts more than any other TIG machine attribute.

“The arc needs to start instantly and it must start precisely where I direct it,” Coleman says. “If the arc misfires, it can do more harm than good.”

The next most important feature is directional control. “If the arc dances around when I’m trying to make a delicate repair in the bottom of a mold cavity, it can damage fine edges the customer doesn’t want touched or lead to excess machining,” adds Canfield.

For positive arc starts at low amperages and for welding aluminum, a TIG inverter will provide the best results and better directional control (Miller’s downloadable PDF provides a good explanation). Also, most of today’s inverters and conventional TIG machines have set up options to tailor

*“The Dynasty draws 7 amps at rated output while Five Star’s other TIG machines draw nearly 100 amps.”*

arc starts for low amperage welding.

For those who prefer traditional TIG power sources, Miller’s new Syncrowave 250 DX and Syncrowave 350 LX now feature Syncro-Start. This technology allows the operator to tailor the arc start to match the tungsten diameter



*As he repairs a damaged injection mold insert, Five Star’s Joe Schultz uses his Syncrowave and  $\frac{1}{16}$  in. tungsten to precisely direct heat to the part. A common marker is used to indicate which parts of the tool need repair, such as cracks, worn edges and faces.*

and application at hand.

**Keep tooling clean.** Remove all dirt, grease and foreign material from the tool. Use a neutral alcohol or acetone for grease or a sandblaster for hard coatings or gunk. To prevent damage to adjacent surfaces, protect them with masking tape before sandblasting. Remove excessively rough crack edges with a hand grinder or carbide tool.

Cleaning the tool doesn’t just prevent weld contamination; it keeps smoky grease from fouling the shop air (any grease will smoke as tooling is preheated, usually to just below the last tempering temperature).

“Suppose an S7 steel was last heated to 700° F,” offers Canfield. “We have to stay below that temperature or we’ll soften the whole piece. But we can heat H13 to 1100F without worrying about harming steel hardness.”

Customers generally indicate the type of tool steel to be repaired, but if not, they follow Five Star’s lead and

perform a hardness test with a Rockwell hardness tester.

### Signature Service

Despite the new trends in the types of tool steels being used today, Canfield says welding techniques are “pretty much the same, no matter what you’re welding. It’s up to the person operating the machine and how they do it best. As far as weave beads and that sort of thing, it all depends on the job. It depends on the amount of weld that has to be built up, how large of an area you have to cover and how fast you want to do it. I’d say everybody has his or her own signature. I can look at a finished weld and tell who did it. Everyone here can do that,” Canfield says. Of course, not everyone works at Five Star Tool Welding. ♦