ARC MAGAZINE

Spring 2015 | **lincolnelectric.com**

First Response Team of America
The Beginning of Hope

Tips & Tricks
Troubleshoot Your Way To Better MIG Welds

Jessi Combs
Fast and Curious

YOUR **MONEY MATTERS™**

POWER MIG® 140C
MIG welder
$680
after rebate

POWER MIG® 180 DUAL
MIG welder
$889
after rebate

Square Wave® TIG 175
TIG welder
$1,805
after rebate

POWER MIG® 256
MIG welder
$2,230
after rebate

OR

OR

OR

OR

OR

To learn more go to www.lincolnelectric.com/moneymatters

(Customer pricing determined by suggested retail price less manufacturer rebate)

EFFECTIVE: March 15, 2015

CASH REBATE OR FREE GEAR

ON ANY OF THESE GREAT WELDING PRODUCTS*

Ranger® 225
Engine-driven welder

$3,400
after rebate

Ranger® 250 GXT
Engine-driven welder

$4,030
after rebate

OR

OR

OR

OR

2YEAR EXTENDED WARRANTY

*A two-year extended warranty may be substituted for rebate or gear on eligible products.

LINCOLN® ELECTRIC

COVER STORY

Jessi Combs

Fast and Curious

This automotive designer and fabricator, land speed record holder, TV host, and advocate for women in welding and fabrication is on a neverending quest for adventure.

14

First Response Team of America

The Beginning of Hope

When a natural disaster strikes anywhere in America, Tad Agoglia and his crew arrive in the immediate aftermath to lend a hand.

22

CONT

CONTENTS

ARC

This icon means there's additional content available on the tablet version of *ARC Magazine*. Access it by downloading the Lincoln Library App, available in Apple's App Store and Google Play.

ARC MAGAZINE

Publisher
Craig Coffey
publisher@arcmagazine.pub

Editor
John C. Bruening
editor@arcmagazine.pub

Art Director
Maggie Mackura
design@arcmagazine.pub

Advertising Manager
Alicia Brzozowski
advertising@arcmagazine.pub

Digital Media Manager
Rob Bruder
apps@arcmagazine.pub

Circulation Manager
Troy Sympson
circulation@arcmagazine.pub

Reprints Manager
Erin Abed
reprints@arcmagazine.pub

Photography
Jenny Ogborn
photos@arcmagazine.pub

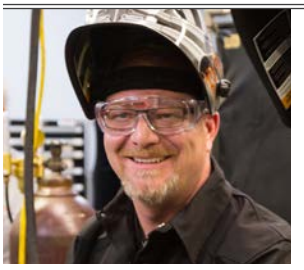
facebook.com/LEArcMedia

@LE_ArcMedia

CONTRIBUTORS

David Murray
Writer

David Murray writes on a wide range of subjects—politics, motorcycling, murder, golf, ballet, sailing, professional poker and speechwriting—for media outlets like *The New York Times, The Atlantic Monthly, Chicago Magazine, Advertising Age* and *Road Racing World*. With a young Army officer dying of cancer, he co-wrote the *New York Times* best-selling memoir titled *Tell My Sons*, and he has just published a memoir about his ad exec parents, *Raised By Mad Men*. He lives with his wife and daughter in Chicago.



Mark Prosser
Instructor

Mark Prosser is a Certified Welding Inspector/Educator (CWI/CWE) who has taught at the college level for 11 years. He has welded in the automotive and motorsports industries, for a governmental contract shop, and on high-pressure chemical piping and aluminum tubing. Mark has authored numerous instructional books, including *Full Bore Welding* and *Full Bore Sheet Metal*, both of which he co-wrote with Bryan Fuller.

Karl Hoes
Instructor

Karl Hoes has been a welding instructor at The Lincoln Electric Company since 2003. He has taught many aspects of the welding school curriculum, including basic and advanced motorsports classes. He has trained welders and instructors at multiple welding schools and national union training programs across the country. Karl is a Certified Welding Inspector/Educator (CWI/CWE).

Jason Radcliffe
Designer/Craftsman

Jason Radcliffe, founder and owner of 44 Steel in Cleveland, Ohio, is a custom designer of stainless steel, aluminum and wood furniture. He creates innovative pieces influenced both by industrial fabricating and the clean, contemporary designs of Frank Lloyd Wright. He recently appeared on *Framework*, the furniture building competition program on the Spike network.

WANT TO SUBSCRIBE?

Shoot us an email!
Send your name and address to circulation@arcmagazine.pub and we will get you on the list!

The VIKING™ 1840 Aztec helmet: More optical clarity. No más dinero.

The **VIKING™ 1840 Aztec™ helmet**, the most economical auto darkening helmet in its class, provides the best optical clarity available in a welding helmet today. External control allows for quick and easy shade changes. The 1840 Series offers an improved headgear for greater comfort and optimal fit.

To find out where to buy, visit www.lincolnelectric.com

LINCOLN ELECTRIC

Firing Up the Arc

Dear Reader,

What you're holding in your hands is the premiere issue of *ARC Magazine*. Based on the title and some of the imagery, it's not hard to guess that it's about welding. But it's also about a lot more than that.

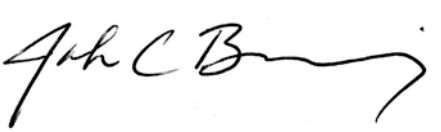
If you're a beginner, *ARC* aims to make welding and metalworking more accessible and less intimidating, and give you the tools you need to be successful. If you're a veteran, *ARC* will help you take your craft to another level by connecting you with other experts in the field. We've tried to make *ARC* informative, but just as important, we've tried to make it entertaining by featuring articles and interviews that we think will appeal to the welding and metalworking audience. Yes, *ARC* is about welding, but it's also about the topics we think welders will enjoy.

ARC Magazine is about connecting you with celebrities like Jessi Combs, a welder and fabricator who has also put the spotlight on automotive design and racing for a mainstream audience like no one else before her. It's about introducing you to organizations like First Response Team of America, a crew of selfless and determined individuals who mobilize at a moment's notice to provide assistance to communities and families all over the country in the immediate aftermath of natural disasters.

ARC is for anyone who shapes metal in some form or another to push their envelope of choice – be it in manufacturing, art, entertainment, community service or some other passion – to new limits and new heights. In either a high-profile or modest way, either on the job or on the weekend, you're one of those people. Or at the very least, you aspire to be. That's why *ARC* is for you.

So tell us what you're thinking. Let us know what you like, what you don't like, what you want to see more of – and yes, even what you want to see less of. We're listening, and we're ready to respond. Let us know the challenges and issues you're dealing with, and we'll address them in these pages. *ARC* is your magazine, after all, and it's about a lot more than just welding. It's about a life you've chosen and all the things you do to get the most out of it.

Sincerely,



John C. Bruening
Editor in Chief
editor@arcmagazine.pub

Get more from *ARC Magazine!*

EXCLUSIVE ADDITIONAL CONTENT:

MORE STORIES

MORE IMAGES

MORE VIDEO

DOWNLOAD THE TABLET EDITION TODAY!

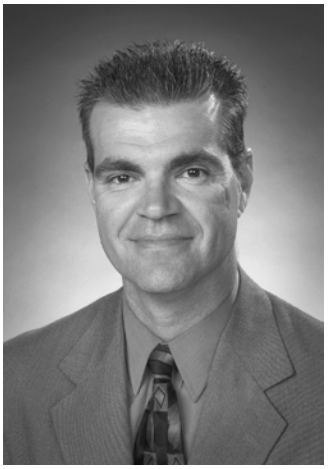
Available for FREE in the Lincoln Library App.

www.arcmagazine.pub

Available on the App Store

GET IT ON Google play

ASK THE EXPERTS



Lincoln Electric Application Engineering Manager Michael Flagg and his team answer your welding questions.
Looking for guidance with technical issues? Contact us at questions@arcmag.pub

Which consumables are better for welding over rusty, dirty steel?

As a general rule, steel surfaces should be cleaned of any oil, grease rust and mill scale before using any type of filler metal or consumable for any arc welding process. These are all surface contaminants that can potentially adversely affect weld quality. However, sometimes complete cleaning of the steel surface cannot be performed. In these cases, the recommended consumables for “dirty” steels are those that form a slag, have deeper penetration, have a slower freezing puddle or have higher levels of silicon and manganese. Lincoln Electric has a number of consumable products that serve this purpose, including (but not limited to):

SMAW	GMAW	GMAW-C (Metal Core)	FCAW-G	FCAW-S	SAW
Fleetweld® 5P+	SuperArc® L-56®	Metalshield® MC-6®	UltraCore® 70C	Innershield® NR®-311	Lincolnweld® L-50® wire
Fleetweld 5P	SuperArc L-59®	Metalshield MC-710XL®	UltraCore 75C	Innershield NR-305	Lincolnweld L-61® wire
Fleetweld 180	SuperGlide® S6		Outershield® 70		Lincolnweld 760® flux
Fleetweld 35					Lincolnweld 761® flux

NOTE: These consumable products may be inappropriate for use because of other variables, such as the need for out-of-position welding, multiple-pass welding, applications requiring low-hydrogen filler metals, etc.

How important is a good electrical ground in MIG welding?

In arc welding, an arc is established from the electrode to the workplace. To do this properly, the arc requires a smooth flow of electricity through the complete electrical circuit, with minimum resistance. If you crimp a garden hose while watering the lawn, the flow at the sprinkler head is greatly reduced. Beginning welders often make the mistake of attaching the work clamp (or electrical ground) to a painted panel or a rusty surface. Both of these surfaces are electrical insulators and do not allow the welding current to flow properly. The resulting welding arc will be difficult to establish and not very stable. Other telltale signs of an improper electrical connection are a work clamp that is hot to the touch or cables that generate heat. Another key point to consider when attaching the welding ground is to place the ground on the piece being welded. Welding current will seek the path of least resistance, so if care is not taken to place the welding ground close to the arc, the welding current may find a path unknown to the operator and destroy components not intended to be in the welding circuit.

What is the proper stress relieving practice for aluminum welds?

When welding, the operator sets up residual stresses around the vicinity of the weld because the molten material shrinks as it solidifies. Furthermore, when the operator takes this welded structure and starts removing material by machining, it tends to distort and create dimensional instability. To avoid this in aluminum, operators perform stress relieving by heating the material to a temperature hot enough to allow the aluminum atoms to move around.

For steel, the stress relieving temperature is approximately 1050° to 1100° F, but for aluminum, the proper stress-relieving temperature is 650° F. This means that in order for post-weld stress relief on aluminum to be effective, the material will have to be heated to a temperature where mechanical properties will be lost. For this reason, post-weld stress relief is not recommended for aluminum.

What does low X-factor mean?

The Bruscato X-factor is a way to measure temper embrittlement resistance in applications where the weld metal deposit may be exposed to high temperatures over a long period of time. Certain residual elements (phosphorus, tin, antimony and arsenic) migrate to grain boundaries over time in these high-temperature conditions, causing a loss of toughness. This is known as temper embrittlement.

The X-factor is a numerical value that is calculated based on levels of residual elements in the weld deposit. Lower X-factors represent lower levels of these tramp elements and higher resistance to temper embrittlement. Many customer specifications in the pressure vessel and petrochemical industry call for E8018-B2 or E9018-B3 electrodes with and X-factor of less than 15.

When should I use 308L, 309L or 316L filler metal?

308L (including ER308LSi) is predominantly used in austenitic stainless steels, such as types 301, 302, 304, 305 and cast alloys CF-8 CF-3. For high temperature applications such as the electrical power industry, the high carbon 308H electrode provides better creep resistance than does 308L.

316L (including ER316LSi) filler metal should be used with 316L and 316 base metals. CF-8M and CF-3M are the cast equivalents of 316 and 316L, respectively.

Use 309L (including ER309LSi) when joining mild steel or low alloy steel to stainless steels, for joining dissimilar stainless steels such as 409 to itself or to 304L stainless, as well as for joining 309 base metal. CG-12 is the cast equivalent of 309. Some 308L applications may be substituted with 309L filler metals, but 316L or 316 applications generally require molybdenum and 309L contains no molybdenum.

Type 347 stainless steel filler metal is ideal for 347 and 321 base materials because it matches these stabilized grades. CF-8C is the cast equivalent of 347. Type 347 filler metal is also suitable for most 308 filler metal applications.

What precautions should I take when welding T-1 steels?

T-1 is a quenched and tempered steel. Welding quenched and tempered steels may be difficult due to its high strength and hardenability. The base steel around the weld is rapidly heated and cooled during welding, resulting in a heat affected zone (HAZ) with high hardness. Hydrogen in the weld metal may diffuse into HAZ and cause hydrogen embrittlement, resulting in delayed underbead or toe cracking outside the weld. To minimize heat affected zone cracking, follow these steps:

- Use a low-hydrogen consumable, like a –H4 or –H2.
- Preheat. This slows the cooling rate. Note that excessive heat may anneal the base material.
- Slow cool. More time at elevated temperatures allows the dissolved hydrogen to escape.
- Peen the weld beads to minimize residual weld stresses.
- Use the lowest strength filler metal meeting design requirements. If making fillet welds, the weld can be oversized to give the specified strength.
- Minimize weld restraint.

What does the designator HR4 mean?

Welders accustomed to using a low-hydrogen electrode with a particular classification are sometimes puzzled when they encounter electrodes with added designations such as "HR4."

Low-hydrogen electrodes are generally used in more critical applications to begin with, and their concern is understandable. However, it's simply a case of the manufacturer providing more information on the same electrode as before.

The added characters are optional designators, permitted by the AWS classification system, to clarify the low-hydrogen characteristics of carbon steel and low alloy steel manual electrodes. Nothing in the electrodes themselves has changed.

Low hydrogen is defined as less than 16 ml per 100 grams of weld metal. This classification has now been stratified into three levels, so the added designators make it easier to quickly determine how "dry" a particular electrode is. The levels are H16, H8 and H4, corresponding to 16, 8 and 4 ml per 100 grams of weld metal. These represent the maximum diffusible hydrogen levels obtainable with a specific product.

One additional designator may also be added. This is an optional moisture-resistant designator (R), which indicates a low-hydrogen electrode's ability to meet specific low-moisture pickup limits under controlled humidification tests. This generally indicates that the electrode's coating has been formulated with non-hygroscopic materials and will resist picking up moisture longer than electrodes with standard low-hydrogen coatings. This can be important when welding in humid areas, since a standard coating will be affected by moisture in about two hours, while a moisture-resistant coating can be safe for use for as long as 10 hours.

When these suffixes are used, they must be imprinted on the electrode itself, in addition to appearing on the packaging. The actual AWS classification does not change when they are added, however. For example, an E7018 H4R product will still be classified as E7018, although the product is identified by the full designation.

With any low-hydrogen consumable, it is important to observe proper storage procedures. Products such as the H4R electrodes come in a hermetically sealed can. Once opened, they should be stored in a rod oven until used, since they may not meet specifications if left open in high humidity. When in doubt about low-hydrogen electrodes and their application, consult the supplier for recommendations.

What consumables should be used for weathering steel?

Core Ten steels (A242 and A588) are weathering steels commonly used for outdoor structures. These steels have a higher resistance to atmospheric corrosion than typical mild steels. Welds on these steels are often specified for similar corrosion resistance and color match.

On single-pass welds, mild steel electrodes are commonly used. There is usually enough pickup from the base metal to obtain good color match.

On multiple-pass welds, low-alloy electrodes are commonly used to obtain a good color match and similar corrosion resistance. The electrodes commonly specified include those with the suffixes –C1, –C2 and –C3. ARC

WIN THIS HAT!

SUBMIT YOUR QUESTIONS TO **QUESTIONS@ARCMAG.PUB**.
IF IT GETS PUBLISHED, WE'LL SEND YOU THIS HAT!

You could stay on the fence, or you could **fix it.**

Don't agonize about buying a welder. First, make sure it's **RED**. Second, make sure it's a **POWER MIG® 210 MP.** At 40 pounds, this machine can go anywhere, and with two voltage options, you can plug it in anywhere, too. The push button controls and LCD screen make setup a breeze, and with the versatility to weld Stick, MIG, Flux-Cored and TIG, you'll have all the welder you'll ever need, **for just $999.** Get off the fence and get it done with the **POWER MIG 210 MP.**

For more information visit www.lincolnelectric.com

LINCOLN® ELECTRIC

FAST AND CURIOUS

Jessi Combs' neverending quest for adventure

By John C. Bruening

“Anything is possible. There are no limitations to what you can accomplish.”

Jessi Combs has a long to-do list, just like the rest of us.

Hers might include some of the usual stuff, maybe something about stopping at the grocery store or getting the laundry done. But after that, things get a little more ambitious: rebuilding custom cars, breaking land speed records, competing in races all over the globe, leveraging electronic media to showcase automotive fabrication and motorsports for a mainstream audience, and creating a space where other women with automotive interests like hers can feel supported and empowered.

And that's just today's list. "It constantly evolves," she says.

That insatiable thirst for something new is what turned an unassuming young girl from Rapid City, South Dakota, with a talent for all things artistic and automotive into a designer, fabricator, competitive racer, veteran television host and relentless seeker of adventure around the next turn and over the next hill.

She's packed a lot into a young life, but she insists that she's just getting up to speed.

A LIFE ON WHEELS

It's hard to say how and when it started. It probably had something to do with the four-wheeling excursions with her parents when she and her brother and sister were growing up, or the hours hanging out in her dad's garage and learning the basics.

It may be in the genes. Dad's a mechanical engineer, and mom was a racer in the 1970s. Her great-grandmother raced too – in the 1920s, when women typically didn't do such things. She also modeled for a Goodrich advertisement, back when the company made its product out of fabric rather than rubber.

"I think our whole family just never limited ourselves to what anybody expected of us based on our gender," she says. "I never grew up that way. One of the most important talks I give when I do speaking engagements is about steering clear of setting boundaries. I didn't have boundaries when I was growing up. I knew the difference between right and wrong, and all the things a kid needs to know, but nobody ever said to me, 'You can't do that, because that's not what girls are supposed to do. That's more of a boy thing.' Because of that, I knew how to go in the direction of all of this adventure and exploration and figuring out what I was capable of. And because of that, I ended up becoming a metal fabricator."

Jessi finished high school with an offer for a full scholarship to interior design school, but she opted out. A different plan was taking shape, but it was taking shape at its own pace.

"I knew that I loved working on my cars and fixing my cars and making them better stronger, faster, lighter," she says. "But it wasn't something that I saw a future in. I thought it was just a hobby that I enjoyed doing, but it wasn't something I could make a career out of…For somebody like me, who's this independent free spirit, I felt like I needed to explore the world yet. I needed to see what was out there before I settled down and decided to do the same thing for the rest of my life."

The exploration led her to WyoTech in Laramie, Wyoming, where she studied fabrication, refinishing and other trades, and graduated at the top of her class with a degree in custom automotive fabrication. Before she even finished at WyoTech, the television opportunities came knocking. She appeared as a guest fabricator on two episodes of *Overhaulin'*, the Discovery Channel series hosted by automotive designer Chip Foose. *Overhaulin'* led to a steady gig as co-host of *Xtreme 4x4* and numerous other how-to and motorsports series that continue to this day, including *The List: 101 Car Things To Do Before You Die, All Girls Garage* and *Mythbusters*.

"I look at television as a giant commercial for promoting this mission that I'm on," she says. "It's the best way for me to show that girls can be anything they set their minds to. I don't do it for the fame, and I most certainly don't do it for the money. It's sad that a lot of people want to get into television specifically for that reason. They don't necessarily want to share a skill set, or share a positive message with the rest of the world. A lot of people want to get into TV because they think they're going to get rich."

A PATCH OF ROUGH ROAD

What she calls "this mission" nearly came to an end in the blink of an eye in January 2007. She was in Nashville, working on *Xtreme 4x4,* when she suffered a severe injury from a 550-pound band saw that fell on her and essentially folded her in half, shattering her L3 vertebrae.

Jessi's mom, Nina Darrington, remembers the phone call from Nashville. Eight years later, it still brings tears to her eyes.

Jessi's great-grandmother, Nina Lester, in a 1920 Goodrich Tire Co. ad in the Saturday Evening Post. *Nina raced cars in the 1920s on Goodrich's fabric tires (before the days of rubber) well beyond their rated mileage. "Our whole family just never limited ourselves to what anybody expected of us based on our gender," says Jessi.*

"They flew me there, and I spent time with her and helped her get through the surgery and the recovery," she said. "The whole time, I just kept thinking, 'Nothing is going to slow her down. Nothing.' She got stronger from there. Most people would have given up and accepted some kind of disability insurance for the rest of their lives, but Jessi said, 'That's not going to be my call. I am going to keep on keeping on.' If it weren't for her fiercely pushing through, she wouldn't be the girl she is today. She just has a drive, and she doesn't want to quit."

She didn't. As part of the surgery, her L1 through L4 vertebrae were fused together to minimize the damage to her spinal column, and she requires ongoing physical therapy, yoga and other measures to keep the pain at bay and stay in shape. In the end, the episode has become part of the mission, and it's motivated her to up her game.

"The story of how I remained determined and how I've pressed on, and how I'm doing more things now than I ever did before the accident, has been inspirational for so many people," says Jessi. "If I can change lives with that story, then I'm going to keep doing it…I call it a blessing in disguise. It was something that I needed that I didn't know I needed. It's like God smacked me upside the head and said, 'It's time for a reality check, young lady!'"

STILL IN THE FAST LANE

Eight years later, her passion for racing – and other adventures on and off the track – is undiminished. She's competed in the Ultra 4 King of the Hammers off-road desert race in Johnson Valley, California, almost every year since 2010. In February 2014, she placed first in KOH's newly established set class, which makes her the first female to ever place in a KOH event in its eight-year history. "That makes me the first Queen of the Hammers," she says.

Unfortunately, her luck at the most recent KOH race in February was not as good. After 61 miles, engine failure took her out of the competition. Definitely a "bummer day," she admitted in a February 5 post on her Facebook page, "though proud of my team and all we accomplished this week."

But there have been plenty of past victories to offset the occasional setbacks. The *coup de grâce* came in October 2013, when she set the women's land speed record in the North American Eagle Supersonic Speed Challenger at the Alvord Desert in the southeast corner of Oregon. Her official run time was 392.954 mph and a top speed of 440.709 mph. The run broke the previous women's land speed record, a 308.51 mph run average set by Lee Breedlove in 1965.

At the time of her interview with *ARC*, she was preparing for the Rally Aicha des Gazelles, a nine-day race across the Moroccan desert in a Toyota Tacoma provided by Total Chaos Fabrication, a manufacturer of off-road truck suspension systems. Nicole Pitell, founder and head of Total Chaos, was scheduled to navigate for Jessi in the rally, which gets under way every year in the last week of March.

"It's one of the most grueling all-female rallies on the planet," says Nicole. "I wouldn't do it if I didn't trust Jessi with my life. She was my first choice of someone whom I would feel comfortable to travel halfway across the world with, and compete with, due to the amount of off-road experience she has. This is probably going to be the adventure of a lifetime, so why not experience it with someone who has a similar never-give-up attitude?"

Somewhere between the racing, the TV hosting, the engagements as a spokesperson for a number of companies, and various other commitments and obligations, Jessi's goal for the near future is to get back into her shop on a more consistent basis and reconnect with her roots as a fabricator. And she wants to take some aspiring young fabricators with her.

The plan is to create what she describes on her website as "a place where badass hotrods, motorcycles, custom trucks, race vehicles, and anything metal will originate with a feminine touch; where chicks can finally have a place to get dirty, be creative, use their skills, explore their talents, go fast and have fun in a comfortable working environment." It's something she already does on an occasional and private basis with small groups, but she wants to expand the vision into something more comprehensive and ambitious in the near future.

"I want to do big camps, and big clinics, and big retreats where people can come to me for long periods of time, and we can get down to the bottom of a lot of things, not just welding," she says. "It'll be framing and wiring and automotive maintenance and gardening and cooking – a lot of self-sustaining, self-maintaining skills… More than anything, it's about giving women the basics, and putting the tools in their hands, letting them make some sparks, and then kind of giving them a little push and saying, 'You can do this. You've got this.' Once they know they can use these tools, they just run wild with it."

Through it all, the good and the bad, an overarching philosophy has emerged, and Jessi shares it with every person she encounters.

"The message that I tell everybody," she says, "the one that I sign on all of my autographs, the one that resonates with me is, 'Never give up. Never, ever give up,' There are so many things that I've learned in my life. Anything is possible. There are no limits to what you can accomplish."

Was this all part of some master plan that took shape once upon a time? When the teenager from South Dakota was getting her first taste of welding and fabricating and working on her first cars, did she envision any of what has come to pass?

"I had no idea," she says. "No idea. But when opportunities present themselves, you hop on them. You never know where they're going to take you." **ARC**

“NEVER GIVE UP.
NEVER, EVER GIVE UP.”

the beginning of HOPE

In the first hours after a natural disaster, numb shock gives way to despair. This is a job for...a former millionaire?

By David Murray

Left: *Tad Agoglia (background) and a local official map out a strategy for deploying the First Response Team in Peoria, Illinois.*

Opposite page (top): *Agoglia maintains a fleet of pickup trucks and other vehicles and equipment at First Response Team headquarters in Lancaster, Pennsylvania, for immediate response to disasters anywhere in the country.*

Opposite page (bottom): *In the aftermath of a tornado in Tupelo, Mississippi, in April 2014, a resident surveys the wreckage that was once her home.*

Tad Agoglia is not a superhero. He doesn't use fantastic physics and magical powers to hush hurricanes and ward off tornadoes. That would be ridiculous.

Instead, he materializes immediately after disaster has struck to begin rectifying the situation with state-of-the-art machinery and near-mystical skill and stamina. That is also ridiculous.

But it's real. And the questions you find yourself asking Agoglia are the same ones a child eventually asks of a superhero: Where did you come from? Why do you do this? *How* do you do this?

THE CALM BEFORE THE STORMS

Agoglia frequently apologizes when he talks about how he came to create the First Response Team of America, an organization that has aided 73 disaster-stricken communities in the last eight years free of charge, fulfilling its philanthropic mission to "fill the gap between the onset of a disaster and the arrival of traditional relief agencies, when too many communities must fend for themselves because the resources necessary for rescue are damaged, inaccessible or unavailable."

He apologizes because he thinks it sounds like he's bragging.

But he's only sharing the facts of his still-young life. It's not his fault they add up to so much.

His father was an Italian immigrant and an entrepreneur. "I got to see a man wake up every day and work until he fell asleep," Agoglia recalls. As a child in Long Island, he felt searing pain in reaction to human suffering. He remembers a boy who got hit by a car, and "seeing him lie on the cold asphalt road in pain."

He studied theology in college, but after earning his master's, he decided he wasn't cut out to be a theologian: "I needed to be a little more hands on." So he went into the excavating business, and made millions in various lucrative ventures, the last of which was a firm that contracted with FEMA and other government agencies to do the necessary but workmanlike debris cleanup in the long wake of disasters like Hurricane Katrina. From the seat of his excavator, Agoglia mused about ways to "use my skills working in disasters, and match them with my desire to help people who are suffering."

On May 4, 2007, a 29-year-old Agoglia was working a routine job in Missouri when an EF5 tornado destroyed the town of Greensburg, Kansas. He left his employees on the paying job – "they thought I was crazy"– and drove his massive debris-hauling rig through the night. After months and years of ruminating about how fire trucks and ambulances get through rubble-filled streets to houses where people are trapped, he realized, "I've just gotta find out for myself."

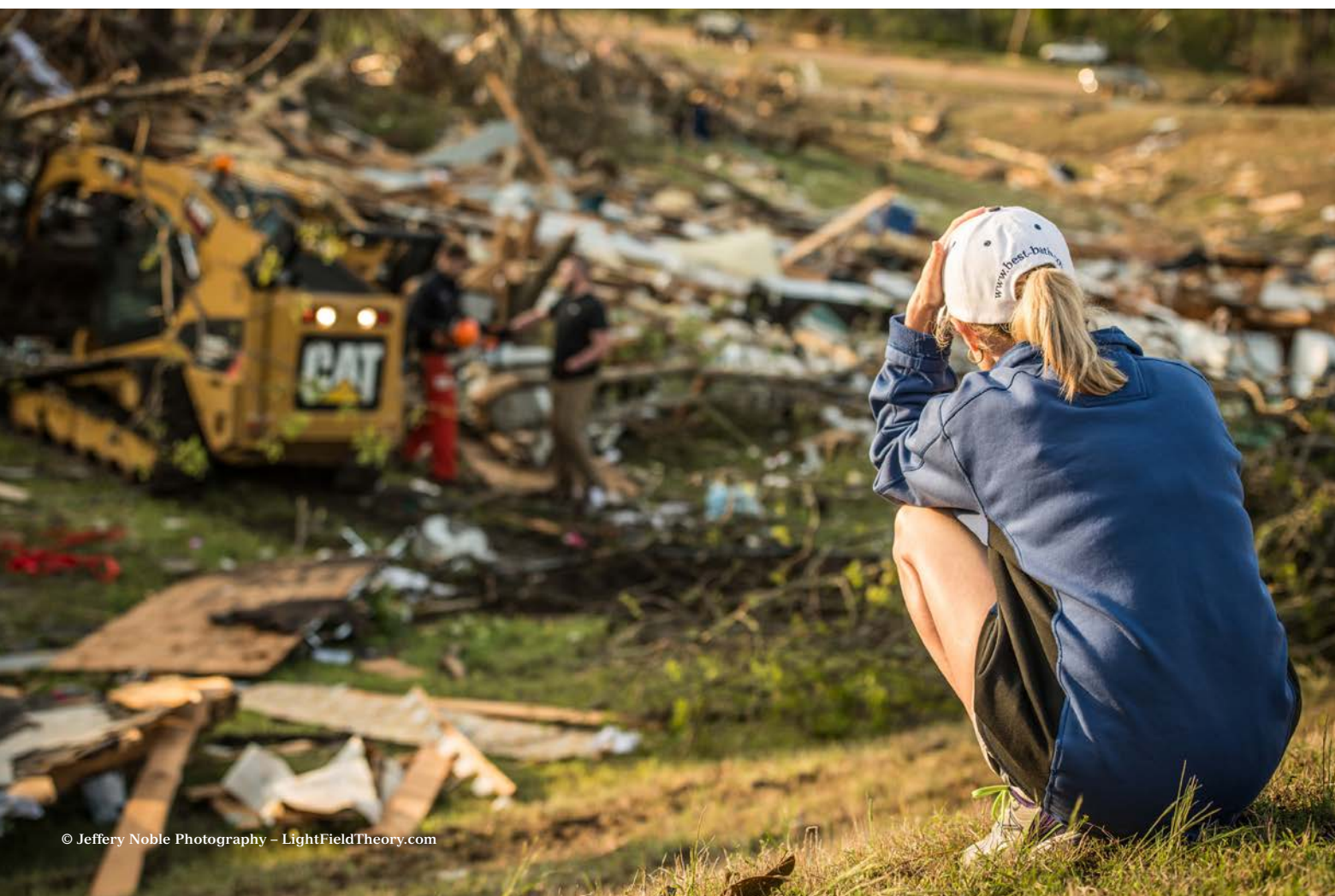
About 30 miles outside of town Agoglia stopped for fuel, and a customer at the station "walked up to me in the darkness" and asked him if he was going to Greensburg. "If you see a girl in her early thirties – she's a veterinarian – tell her her father is looking for her."

It was then that Agoglia fully realized, "I'm going into a very difficult situation of death and destruction."

He didn't yet know he would spend the rest of his life there.

HOW TO MAKE AN IOWA POLICE CHIEF CRY

Chris Luhring was the fortunate beneficiary of Agoglia's second First Response adventure, though he didn't see it that way at first. "When I first met Tad, I was yelling at Tad," says Luhring, who was the police chief of Parkersburg, Iowa, on May 25, 2008, when another EF5 leveled 46 percent of the buildings in the town and killed seven people, including Luhring's own aunt.



Below: *A First Response Team member clears debris from a tornado-ravaged neighborhood in Washington, Illinois, in November 2013.*

Opposite page: *Members of a local family work hand-in-hand with First Response Team personnel to rebuild their hometown of Tupelo, Mississippi, after a tornado in April 2014.*

Luhring was trying to create a secure perimeter for operations and Agoglia's truck was in the way. When Agoglia told him he was there to help, Luhring didn't believe him. "At that point, I didn't trust anybody not from Butler County," he says. His reaction to a stranger claiming he was there to help for no charge to the city? "I may be traumatized," Luhring remembers thinking, "but I'm not stupid."

Yet, Luhring did have some problems that Agoglia was uniquely qualified to solve. Glancing at the destroyed city hall building and the fire trucks rendered inaccessible by twisted steel, and then pointing to his big grapple, Agoglia said, "I can pull out a piece of paper with this grapple, or throw a car across the street."

Over the next two weeks, Agoglia and his newly formed team did for Parkersburg what he would eventually do for so many other towns in the years that followed: he showed a community full of people who were moving from numb shock to hopeless depression that "things are getting done," as he puts it. Luhring describes an epic Sunday operation about a week after the tornado hit, where Agoglia and his tiny crew had 30 large county dump trucks roaring back and forth to keep up with him as he cleared an entire city block's worth of rubble in a day.

"We don't solve all the problems. We can't take away people's pain, but we can give them a little bit of hope," Agoglia says. "And they just run with it."

"I can start crying right now, actually," Luhring tells *ARC* nearly seven years later. Now the town's administrator, he attributes the remarkable speed and scope of Parkersburg's recovery solely to the start Agoglia gave it. He's nearly in tears as he describes what he sees as Agoglia's near-mystical powers of pure altruism.

"In our culture so immersed with celebrity status, Tad doesn't work for the attention," Luhring says. "He works for farmers, for poor people."

© Jeffery Noble Photography – LightFieldTheory.com

FROM SAINTLY TO SUSTAINABLE

But after several years of funding First Response with his own resources, Agoglia was in danger of becoming a poor person himself. He was spending about $70,000 per month fueling and transporting his $2 million worth of equipment from his home base in Lancaster, Pennsylvania. Running out of cash, Agoglia now needed someone to rescue him.

Which is exactly what happened. CNN's Anderson Cooper ran a story on Agoglia, and a middle manager at Caterpillar's headquarters in Peoria, Illinois, noticed that much of the equipment Agoglia was using was Cat. Shouldn't Cat support First Response? Soon Agoglia was offered $250,000 worth of equipment and another $250,000 in cash. As Agoglia scrambled to create a nonprofit organization in order to accept the donation tax-free, Peterbilt stepped forward and offered three free trucks of their own. He's since received donations of cash, equipment and even personnel from a number of companies as well as individuals (see sidebar, page 29).

> "We don't solve all the problems, we can't take away people's pain, but we can give them a little bit of hope," Agoglia says. "And they just run with it."

Eight years after starting First Response, Agoglia doesn't actually have a place to live. He doesn't need one. When he isn't working a disaster, he's traveling the country raising money or doing publicity for First Response in the interest of raising money.

And when he's not doing that, he's scouring Lancaster and the surrounding area for crew members who can hack this technically demanding, emotionally draining, unpredictable, exhausting work.

Turnover is high. Why? To work on First Response's three- to four-man crew, one must have a CDL license and experience operating cranes, excavators, loaders, dozers, backhoes and chainsaws. Agoglia's stated job requirements are almost laughably stringent: "flexibility

to be on-call at a moment's notice, seven days a week, 24 hours a day, and on the road for eight to 10 months throughout the year … ability to use good judgment and remain calm in high-stress situations … ability to be unaffected by loud noises and flashing lights … ability to work in low-light situations and confined spaces … ability to withstand varied environmental conditions such as extreme heat, cold and moisture."

And all, especially in the early days after a disaster, with very little sleep. At 19, Timothy Wolkowicz was the crane operator in that *Mike Mulligan and His Steam Shovel* scene in Parkersburg. Now 26 and Agoglia's first mate, Wolkowicz says the typical job starts with a sleepless night of driving to the disaster area. "We get there at sunup, work all day, sleep for a couple of hours, and then early the next morning, do it all over again." He thinks he and Agoglia are unique in their ability to work sleeplessly and safely, but "I know my limits."

First Response's newest employee is still learning hers.

A young neuroscience researcher at Johns Hopkins, Nga Chau moonlights between observing brain surgeries and driving First Response trucks as the third member of Agoglia's small traveling crew. Her first job was in December, when a tornado struck Columbia, Mississippi, two days before Christmas. First Response arrived on Christmas Eve, with Chau learning on the job how to operate a compact track loader, a skid steer and a chainsaw, all in a combination of awe and anxiety at what she was seeing firsthand for the first time.

"You have to figure out where to start," she says, "because everything is everywhere."

By the time she and First Response left Columbia, everything wasn't everywhere. Linda Bolton's home, for instance, was cleared from her lot. "It's just a blessing," she told The Weather Channel about First Response. "You just can't find people like that every day."

Or as Parkersburg's Luhring put it seven years after meeting a guy who seemed too good to be true, "Tad is my best friend who I've only seen for 13 days."

Meanwhile, Agoglia's manic lifestyle doesn't leave much room for friends or family, except for those he has helped, those who have helped him—and the thousands of unsuspecting people he'll help in the future.

"My life has become this work," Agoglia says, "and they are my family." ARC

WHO MAKES THIS IMPROBABLE STORY POSSIBLE? **YOU DO.**

"What food is to the Red Cross," Tad Agoglia says, "equipment is to First Response." A big part of his work involves soliciting donations of new equipment – not just the big stuff like cranes and backhoes but smaller stuff, like water pumps, rubble cameras, underwater cameras, infrared cameras, light towers, hover crafts, generators and any number of other tools.

If you have equipment or other resources that you think First Response could use, contact the organization at:

inquiries@firstresponseteam.org

And here's a partial list of companies who have donated equipment, loaned personnel or offered cash infusions to First Response:

- Caterpillar Foundation
- Chrysler Foundation
- DAS Companies
- Ledwell & Son
- Lincoln Electric
- Lowe's
- The Pete Store
- Prime Legacy Management
- RAM

Opposite page: *Peoria, IL in 2013*

Left, from top: *Washington, IL in 2013; Pennsylvania, 2014; Washington, IL in 2013; Pennsylvania, 2013*

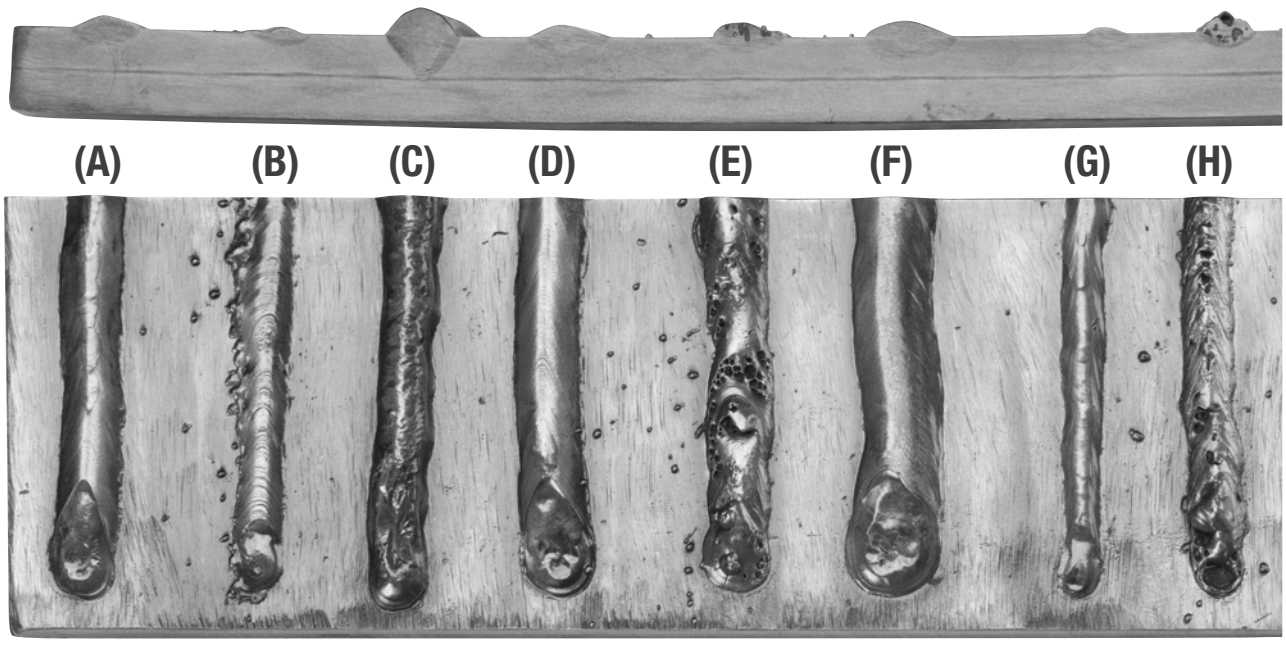
TROUBLESHOOT YOUR WAY TO BETTER MIG WELDS

By Mark Prosser
Certified Welding Educator (CWE),
Co-author of *Full-Bore Welding*

Congratulations! After much deliberation (maybe too much), you've finally invested in that new welder you'd been thinking about for a while, and you've taken some of your first steps into the world of welding. At the very least, you've probably set up the machine, reviewed the manual and made a few sparks. The only thing left for you to do is invest some time in learning a bit of theory and technique, and develop an understanding of some typical weld problems and ways to respond to them.

The image below illustrates several different types of weld problems. The solutions are usually just a matter of a few simple adjustments, but they're not always that obvious. This column looks at some typical weld issues and offers suggestion about how to fix them.

Once you've turned on your machine, but before you start welding, take a minute to just listen. What you hear can tell you plenty. The rule of thumb is that when a machine is adjusted properly, it sounds like bacon frying in a pan. You should hear a smooth, consistent sizzle. The weld on the far left in the image below is smooth, straight, even and consistent in length and width (A). It's a good example of what your MIG welds should look like.



(A) Proper wire feed speed (WFS), voltage, electrical stick-out (ESO) and travel speed

(B) WFS too low

(C) WFS too high

(D) Electrical stick-out (ESO) too short

(E) Electrical stick-out (ESO) too long

(F) Travel speed too slow

(G) Travel speed to fast

(H) Inadequate gas coverage

WIRE FEED SPEED TOO LOW

Wire feed speed controls amperage. Think of amperage as heat: the higher the amperage, the more heat in the puddle. If your wire feed speed is too low, it will not generate enough heat to melt the amount of filler wire being fed into the puddle. You can see from the illustration that the molten puddle is not fused very efficiently into the base metal. Instead, it just lays on top of it. The result may be a decent-looking weld, but there's little or no fusion. This is a potentially dangerous issue with MIG welding.

THE FIX: At the beginning of your weld, increase your wire feed speed slowly – in small increments, without adjusting the voltage – but also make sure your arc length remains stable and consistent. Turn the wire feed speed up until the metal begins to melt smoothly and that satisfying sound of frying bacon is ringing in your ears.

WIRE FEED SPEED TOO HIGH

When the wire feed speed is too high, the puddle becomes too fluid and there's simply more molten metal than what can properly fuse into the base metal. This makes for wide beads that are usually flat, and sometimes even concave. It makes the weld harder to control, and believe it or not, can even lead to problems with insufficient fusion.

THE FIX: Reduce the feed speed in small increments until you get the desired results. Depending on the material thickness, you can also add voltage to help smooth the process.

ELECTRODE STICK-OUT

Electrical stick-out is very important. Improper stick-out can greatly reduce the integrity of a weld. When the electrical stick-out is too short, it does not allow space for the arc to work properly, heat the base metal properly or melt the filler properly. When the stick-out is too long, the amperage decreases and therefore the heat decreases, which results in a cold weld. This is usually characterized by a tall narrow weld that is not fused well on the edges.

THE FIX: Try positioning your head so you can see the weld better. Following visual cues is very important in the welding process. Make yourself more comfortable, brace your body and use your free arm to steady the arm with the gun in it. Before you actually weld, try a few dry runs by moving the gun across the weld joint without pulling the trigger.

TRAVEL SPEEDS

A good MIG weld requires you to keep the wire on the leading edge of the puddle. Some think slowing down the travel speed will increase penetration, but it doesn't. If your travel speed is too slow, you'll produce a lot of melted wire with little fusion into the base metal. A travel speed that's too fast doesn't allow the puddle time to do its job. A weld puddle can very quickly become to cold by traveling too fast.

THE FIX: As mentioned earlier, paying attention to the visual cues can be helpful. Watch the puddle. Keep the wire on the leading edge of the puddle and move as fast as you can while keeping the puddle "round."

INADEQUATE GAS COVERAGE

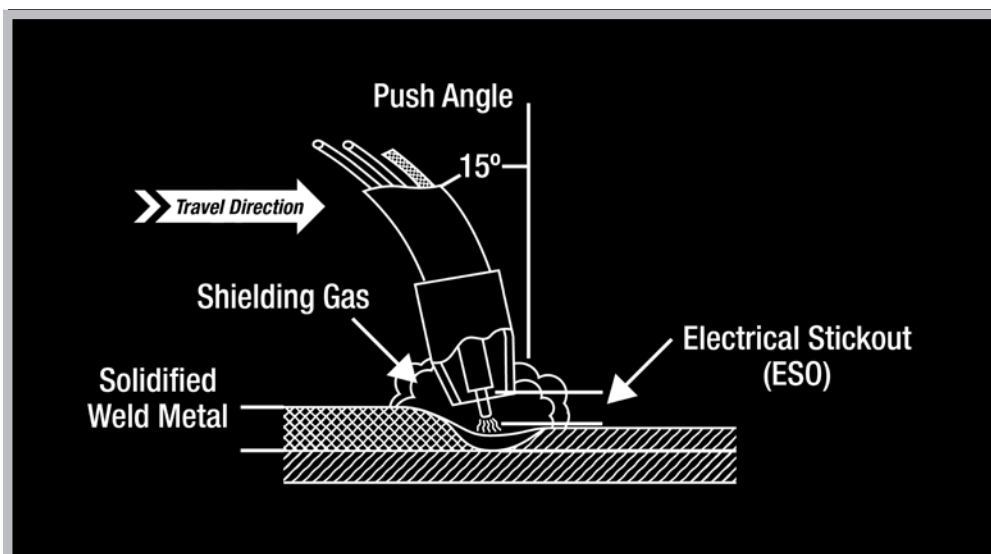
Lack of gas coverage causes holes in the weld, a phenomenon better known as porosity. This destroys the quality of the weld and makes a weld very weak. The most common causes of inadequate gas coverage are a draft or breeze, a pinched gas line, a loose fitting, insufficient gas flow or even too much spatter in the nozzle of the gun.

THE FIX: Block any drafts in the work area. Check your system for leaks, clean the nozzle, make sure the gun is seated all the way into the machine, and check the hose for holes.

GUN ANGLES

We generally work with two gun angles, and consistency with these two angles is important to the making of quality welds. **Work angle** is the angle of the gun, which splits the weld between the two pieces of material. We usually always want the same amount of weld on each piece unless welding thicker metal to thin metal. **Travel angle** is the angle at which we hold the gun when pointing in the direction of the weld.

The gun angle is important in that it directs the weld where it needs to go and ensures a quality weld when the job is complete. You can adjust angles according to what the puddle says.



SOME ADDITIONAL TECHNIQUES

Whipping the gun is a very helpful technique when welding the thinner materials that we frequently encounter in our smaller shops. This technique can lead to fusion issues on thicker materials, but it's very helpful when used properly on materials in the 3/16″ range or thinner. I use it almost every time I pick up my MIG welder in my garage.

Whipping is basically a heat control technique used to flatten the weld. The same technique is used with a 6010 stick-welding electrode. It's especially helpful with any sort of automotive welding. It creates less heat input, which results in less distortion and produces a better-looking weld. Whipping will also save a lot of grinding time in the finishing process because the welds are much flatter. In fact, once you master this technique, your welds will look so good you may not need to do any grinding at all.

Here's how it works. As you make your way along the weld, quickly whip your gun/wire forward, just past the front edge of the puddle and then back onto the puddle. The forward motion pulls heat out of the puddle to flatten it, and then the backward action builds the puddle up to fill the weld to proper height. This action pulls some of the molten metal out of the center height of the weld and pushes it to the sides, which facilitates wetting the puddle into the base metal.

Be sure not to whip too far off the puddle. This can impede fusion on thick materials, but it isn't a big concern on the thinner materials. After some practice, this technique can be very effective and create quality welds with an excellent appearance that requires very little finishing, if any.

Triggering is another technique that can be especially helpful when welding materials in the 16-gauge range and thinner. This technique is also commonly referred to as "the poor man's pulse." When welding automotive sheet metal, triggering is basically a series of overlapping tack welds.

Pull the trigger and make a nice, round tack weld. Then move the gun forward about half the distance of the previous tack and pull the trigger again. Repeat this process all the way across the weld joint.

Triggering can produce flat, smooth welds on very thin and temperamental sheet metal. It can also be very helpful when the material fit-up is less than perfect – which is often the case. The larger MIG welders have pulse features that perform this technique automatically, without the operator having to pull and release the trigger. In addition, some machines have a "stitch welding" feature, which is similar to triggering.

As with any welding technique, you can master whipping and triggering with a little practice. When executed properly, both can be very effective on thinner materials.

When you're just getting started in welding, there are many factors to consider. The pitfalls and techniques described here are some of the most common. Just remember that welding is all about variables and keeping them in the range necessary to make a good, strong weld.

Welding is also all about having fun. So get out to the garage with that new welder and build something. **ARC**

SELECTING FILLER METAL FOR ALUMINUM ALLOYS

By Karl Hoes, Welding School Instructor
The Lincoln Electric Company

Alloy Series	Primary Alloying Element
1	99%+ pure aluminum
2	Copper
3	Manganese
4	Silicon
5	Magnesium
6	Magnesium and silicon
7	Zinc
8	Lithium, other elements

Whether you're a rookie or a veteran, welding aluminum can be tricky business. The selection of the most appropriate filler metal is a key consideration, and it's based on numerous variables and criteria. In this inaugural Master Class for *ARC*, we'll examine how to choose the proper filler metal when welding aluminum alloys.

Aluminum alloys are made by combining aluminum with other elements. The resulting material will have improved mechanical properties compared to basic aluminum. The alloys present also determine how the mechanical properties can be further improved by mechanical cold work or heat treatments. The wrought aluminum alloys that we are working with today are identified and numbered according to their chemical composition (see chart at left).

The large majority (about 80 percent or more) of the aluminum alloys we typically weld can be successfully joined with either 4043 aluminum alloy or 5356 aluminum alloy.

ALLOYS AND FILLERS

Unalloyed aluminum is seldom used in structural applications because it lacks strength and is extremely ductile. It's easy to bend a 99% pure aluminum rod without using any hand tools for assistance. However, the fabricated part used for this demonstration is made up of three different aluminum alloys: 3003 for the bulk of the part, 6061 for the threaded bungs and 5052 aluminum for the bottom rail.

Given this variety of alloys in a single part, the choice of filler metal for the weld depends on several service conditions:

1. **Strength:** Will fillet welds be subjected to shear loads?
2. **Weldability**: How does the filler metal rate relate to preventing hot cracking?
3. **Ductility:** Will the weld metal be subject to deformation after welding?
4. **Corrosion Resistance:** Will the weldment be used in a seawater or freshwater environment?
5. **Thermal Conditions:** Will the weldment be subjected to sustained temperatures of 150° F or higher?
6. **Anodization:** Will the weldment be color anodized after fabrication?

To illustrate the decision-making process that goes into the choice of a filler metal, let's look at two commonly used filler materials that we may have to choose from for the project – ER 4043 and ER 5356 aluminum – and then walk step-by-step through the choice of filler metal most appropriate for the job, based on service conditions (see the table below for some criteria and general guidelines).

Both filler alloys may be a fit in terms of weldability, but 4043 might be a slightly better choice to use on the somewhat crack-sensitive 6061 and 5052 base metal. 5356 will provide a slightly stronger weld, but for the part we're welding in this demonstration – an automotive valve cover – the fillet welds will not be subject to excessive shear loads in service, so shear strength is not a big concern. Corrosion resistance in salt and fresh water is not a concern for this performance automotive part. However, it would be a factor in marine applications. The piece will not be subject to deformation after welding, so ductility is not a requirement. In this case the part will not be color anodized after welding. If color match after anodizing was important, a filler metal such as 5554 would be selected, as it would color match well and be suitable for the sustained service temperatures anticipated.

The deciding factor in this decision is that the part we're welding will be used in a vehicle, where it will be subject to sustained thermal conditions well above 150° F. Consumer automobile engines run about 190° F for extended periods of time. Aluminum alloy 5356 is not suitable for use in a sustained high-temperature environment. Therefore, of the two, alloy 4043 is the choice for welding this aluminum valve cover and other aluminum auto parts such as oil pans, radiators or cooling parts that are not intended to be color anodized.

If there are any doubts, your best bet is to consult a manufacturer's filler metal chart to properly match the filler metal to the base metal and get the best understanding of the service conditions.

Commonly selected filler alloys	Weldability	Shear strength in a fillet weld	Corrosion resistance in salt and freshwater	Sustained temperatures above 150°F	Color match needed after anodizing
4043	Slightly better	OK	NA	OK	NA
5356	OK	Slightly stronger	NA	Not suitable	NA

CLEAN IT UP, SET IT UP

As always, the parts must be cleaned free of all lubricants and shop dirt before assembling and welding. In this case, a quick wipe with a clean rag soaked in acetone is sufficient. In some cases, such as with aluminum that has been laying around the shop for a while, you may need to do some brushing with a clean stainless wire brush in order to remove excessive contaminated oxides from the surface of the aluminum. When using a power wire brush, be careful not to burnish the aluminum and embed oxides into the surface.

I used a Lincoln Electric Precision TIG® 375 for the job. Shielding gas was 100% argon at a flow rate of 20 cubic feet per hour. I used a number 20 torch with glass lens collet body and a number 7 nozzle with an intermediate back cap. The following settings were preset on the machine, but current was adjusted remotely as needed:

Starting current:	14 amps
Current setting:	Remote control (this is important for aluminum welding, because amperage can be varied as the piece warms up)
Top current:	146 amps
Balance control:	Manual
Polarity:	AC (65-70% negative polarity for cleaning and penetration)
Ground:	Auxiliary

During any welding process, safety is always the first consideration. When TIG welding, the operator should wear the following:

1. A good-quality welding helmet.

2. Safety glasses underneath the welding helmet. These serve two purposes: to protect the eyes from flying objects and to filter out any additional ultraviolet light that might get behind the helmet – possibly as the result of errant arc strikes.

3. TIG gloves to protect against electric shock and ultraviolet light. Keep in mind that all the metal on the bench is part of the welding circuit.

4. Skin protection from ultraviolet light and burns. Any combination of fire-retardant shirt, welding jacket, sleeves, and other protective layers will help keep your arms and neck covered.

FIVE STEPS TO SUCCESS

Aluminum is one of the most challenging materials to weld efficiently. Choosing the proper filler metals will have a direct bearing on the quality of your aluminum alloy welds. You'll get better results when you address all the items on the following checklist:

1. Determine what aluminum alloys you are welding together.
2. Understand the service conditions under which the welded piece will be used.
3. Use a manufacturer's filler metal chart to select the proper filler metal for the base metal and the service conditions.
4. Thoroughly clean all parts prior to assembly.
5. Fill craters at the end of the weld to a convex shape to minimize crater cracks. ARC

The Lincoln Electric Company thanks Moroso Performance Products, a supplier of automotive equipment for racing and street performance applications, for supplying the part used in this demonstration.

Phoenix Fun Zone

The term "advertising agency" might conjure up an image of mad men developing catch phrases or 20-something hipsters designing clever commercials. **Union Digital** would not be one of those agencies. Their niche is the conception, design, production and installation of large-scale fabrication and electronic projects that help their customers create awareness for their products, brands or events.

This Phoenix-based company had their hands full in January, with the creation, design and installation of a huge project in the city's Super Bowl Central entertainment zone for client Tostitos. They converted a downtown city street into a free fan experience, complete with oversized versions of common backyard and carnival style games. All of these games were fabricated from aluminum and sheet metal before being wrapped.

Double Dipper Dunk played like the dunk tank game at your favorite carnival. In the Tostitos versions, players faced off trying to dunk each above 12-foot-tall salsa and queso jars that Union Digital fabricated from aluminum sheets using Lincoln Electric welders and plasma cutters. Losing players landed in gymnastics-style foam pits.

Slingshot Blitz gave players a chance to score points by landing footballs in oversized Pepsi cups within a 30-second shot clock. The cups were designed to be fabricated out of a single sheet of rolled 16-gauge steel and welded together using the new Lincoln Electric POWER MIG® 210 MP.

Mega-Mecha Cornhole was a scaled up version of the widely popular game Cornhole. Instead of physically throwing bean bags, players shot them from a huge, stationary CO_2 powered air cannon complete with ejecting shells. Each table was scaled to eight feet wide by 16 feet long and stood six feet high.

Photos Courtesy of Aaron Rogosin

Double Dipper Dunk

Slingshot Blitz

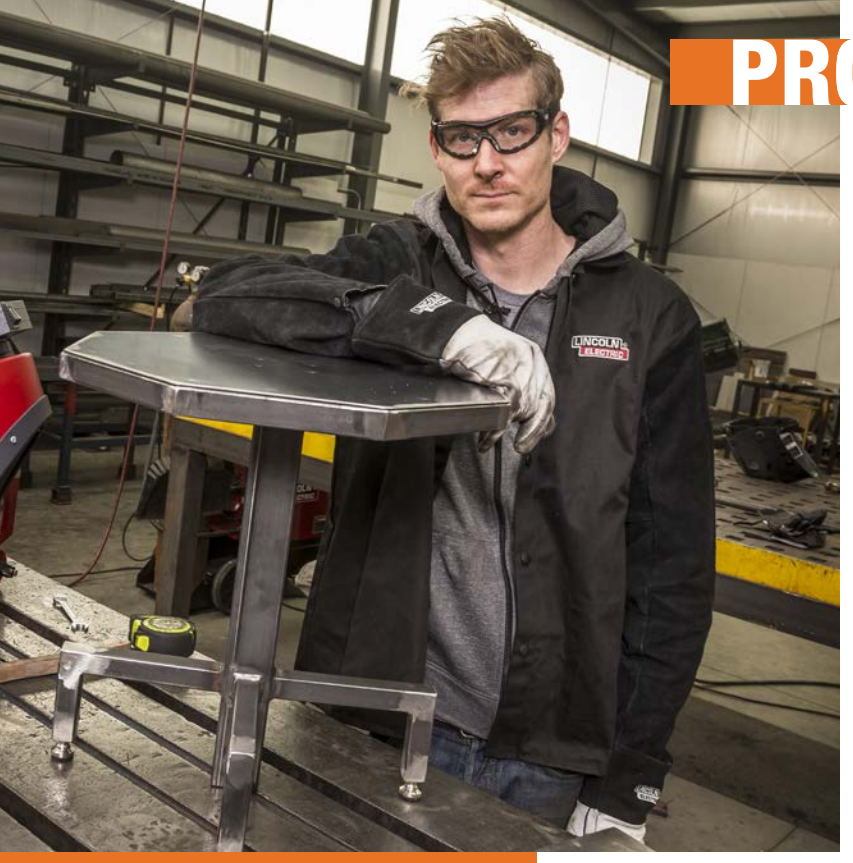
Mega-Mecha Cornhole

Like a red knife through butter.

Whether you're a professional metalworker or a serious home hobbyist, the Tomahawk® line of Plasma Cutters from Lincoln Electric will improve the efficiency and quality of your next metal cutting project. Equally effective at cutting mild steel, brass, stainless, copper or aluminum, these powerful plasma cutters are supremely portable, provide quick, clean cuts and enable hours of maintenance-free operation.

Visit www.lincolnelectric.com for details.

LINCOLN® ELECTRIC



PROJECT SPOTLIGHT

CONSTRUCTING AN INDUSTRIAL-STYLE END TABLE WITH AN OCTAGONAL TOP

JASON RADCLIFFE
Owner and Founder of 44 Steel, Cleveland, Ohio

An end table can be a useful piece of furniture in just about any room in the home. When it's made from unfinished industrial steel, in a shape that doesn't fall into the typical square or rectangular configuration, that useful piece of furniture can also be a stylish addition to the room and an intriguing conversation piece.

With the right materials and tools, building a steel end table with an octagonal top is a relatively simple project.

MATERIALS

- 18" of 2" square tubing
- 12 feet of 1" square tubing
- 20" square (or larger) piece of 14-gauge steel plate
- 3/16" thick, flat stock

WELDING/CUTTING EQUIPMENT

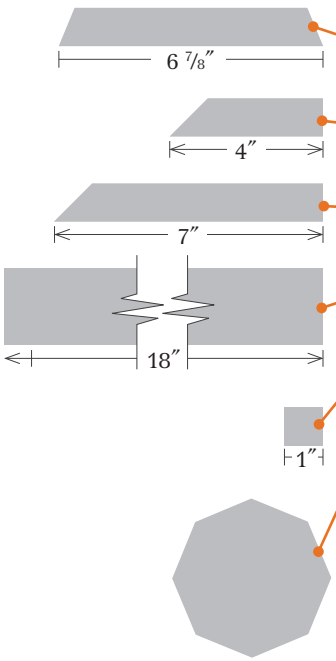
- Lincoln Electric POWER MIG® 210 MP Multi-Process Welder
- Lincoln Electric Tomahawk® 375 Plasma Cutter

ADDITIONAL TOOLS

- Lincoln Electric Radius™ Pivot Angle Magnetic Fixture
- Lincoln Electric Radius Mini Multi Angle Fixture
- Welper® pliers
- Tape measure
- Angle grinder with abrasive disk wire wheel

PERSONAL PROTECTIVE EQUIPMENT

- Welding Helmet
- Welding Gloves
- Safety Glasses
- Welding Jacket or Shirt
- Fume Extraction Equipment



CUT LIST

(8) x 6 7/8" lengths of 1" square tubing, cut at 22 ½° at each end

(4) x 4" lengths of 1" square tubing, cut at 45° at one end

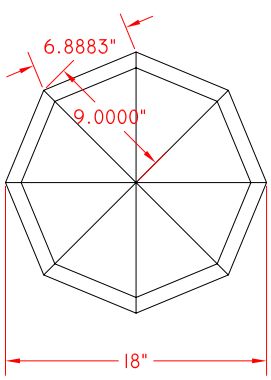
(4) x 7" lengths of 1" square tubing, cut each with a 45° at one end

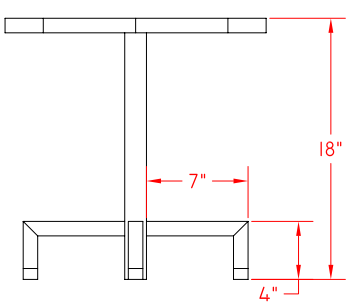
(1) x 18" length of 2" square tubing

(4) x 1" x 1" squares, cut from 3/16" flat stock

(1) x 18" x 18" piece of 14-gauge flat stock, cut to form an octagon

When cutting angles, stay as close as possible to the degrees indicated. **Here's a tip:** Make a paper pattern of every angle to confirm the setting of the saw is correct. Even a 1° error can become a problem the further you get into the assembly process.





POWER MIG 210 MP WELDER SETTINGS:

Process: MIG
Manual CV
Wire feed speed: 180 inches per minute
Voltage: 18 volts

The digital interface of the POWER MIG 210 MP can guide you through the setup process.

PUTTING IT ALL TOGETHER

Before you start welding, make sure your surfaces are as clean as possible. Grind the edges of the pieces to remove any mill scale that might compromise the welds.

Join the end caps to the legs

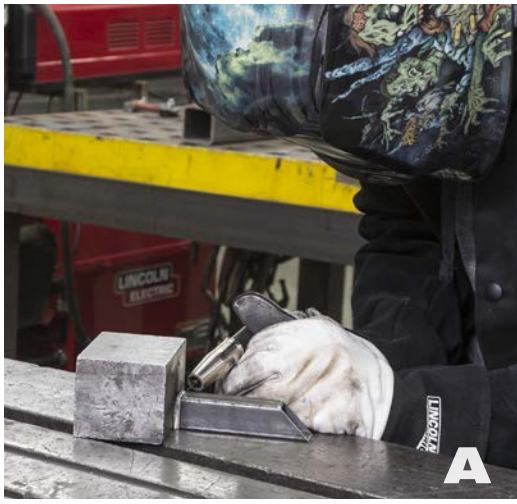
1. Line up the end cap with the flat end of the 4″ vertical pedestal leg piece. Tack weld one corner, then tack the opposite corner, then tack the two remaining corners. Check after each tack to make sure the piece is sitting flat. Then fully weld the end cap piece to the pedestal leg. Repeat for the remaining 3 legs.
2. Grind all welds smooth. (Tip: To make the joints appear seamless, grind the pieces on the flats first. Then grind to match the roll of the tube.)

Join the 4″ vertical leg pieces to the 7″ horizontal leg pieces

1. Line up the angled cut of a 4″ piece to the angled cut of a 7″ piece, using the pivot angle set at 90°. Tack weld the two inside corners of the seam, then the two outside corners. Fully weld all seams. Repeat this process for the remaining 3 legs.
2. Grind all welds smooth and flush.
3. To bring the surface of the pieces to a smooth furniture quality, use a wire wheel to complete the buffing process.

Join the 6 7/8″ top pieces to make an octagonal frame

1. Use the mini multi angle fixture to join the pieces to form the octagon. Use scrap pieces of metal to stabilize the parts for welding.
2. Tack one piece of the octagon assembly to another on the two outside corners.
3. Continue to join additional pieces of the octagon with outside tack welds until the octagon is formed.
4. Draw a template of the 18″ octagonal table top on the 14-gauge steel plate.
5. Double-check the tacked octagon pieces against the template to confirm the parts will fit together.
6. Tack together the inside corners of each of the seams of the octagon frame.
7. Fully weld together all of the octagon pieces. To minimize heat distortion, make alternate welds: weld an outside seam and then an inside seam on the opposite side of the piece. Weld the flats first, then the tops and bottoms.
8. Grind all welds smooth.
9. Use a wire wheel to buff pieces to a smooth finish.

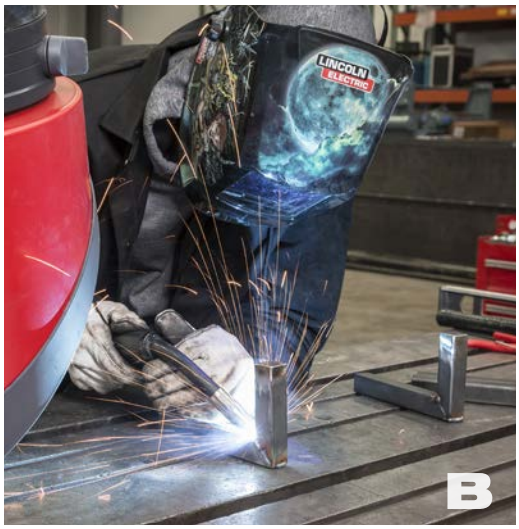


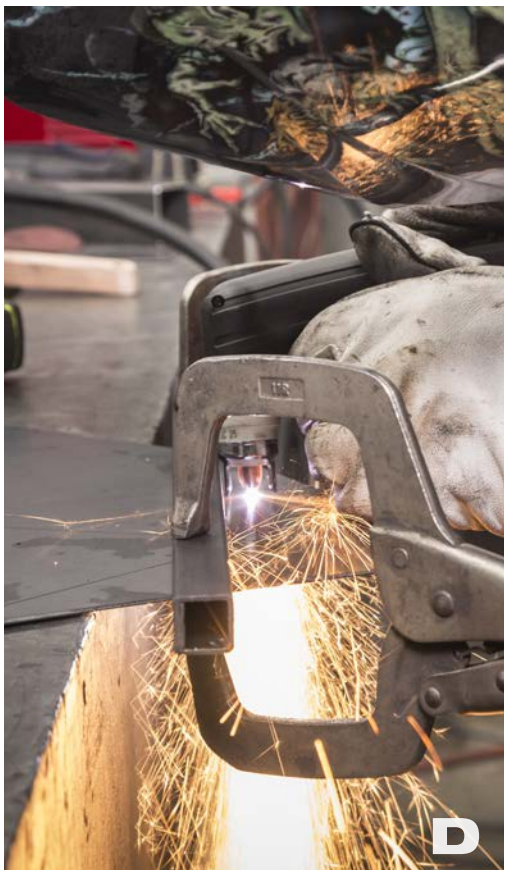
Cut the octagonal table top

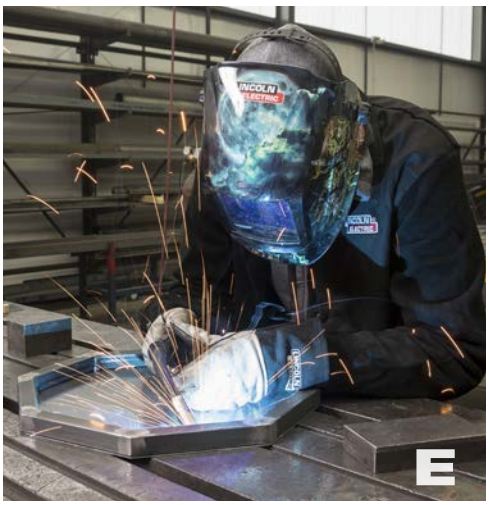
1. Clamp guides at the corners of the steel plate to ensure accurate cuts.
2. Cut the octagonal table top with a plasma cutter.
3. Grind all edges until smooth.

Join the octagonal frame to the octagonal tabletop

1. Place the octagonal plate right side down. Line up the plate with the octagonal frame and apply weights to stabilize the assembly.
2. Tack weld the pieces together at each angle point inside the frame. Any additional welding may warp the flat steel plate.







Attach the legs to the main pedestal post

1. Using the pivot angle magnetic fixture set at 90°, line up a leg to the main pedestal. Use 4" spacers to hold the horizontal section of the leg stable as you weld.
2. Apply one tack weld to a top corner, and then confirm that all angles remain at 90°. Continue to apply the tack welds, opposite corner to the first, then the remaining two.
3. Attach the other three legs with tack welds, using the same method.
4. Clean off any high spots from the tack welds with a wire brush.
5. Fully weld the legs to the pedestal base.

Attach the pedestal post to the table top.

1. Place the welded table top assembly face down. Position the pedestal base in the center of the tabletop, checking that it is centered and perpendicular.
2. Tack two corners and check again for accurate positioning.
3. Complete the remaining two tacks.
4. Reinforce the tacks on all four corners. Do not weld this joint completely to avoid warping the top.

When you're finished, it'll probably be time for a cold beverage. Now you'll have a cool looking steel table to put it on. ARC

Welding for the Ultimate Winter

October, 1939 – Workers at the Lasker Boiler & Engineering Company in Chicago, Illinois, fabricate one of the half-ton wheels for the Snow Cruiser, the primary transport vehicle for Admiral Richard E. Bird's second Antarctic expedition. Once completed, the wheels spanned a 20-foot wheel base and were fitted with 12-ply Goodyear tires. The 75,000-lb., 55-foot-long Snow Cruiser arrived in Antarctica the following January, but fell short of performance expectations when the tires sank deep into the snow and spun too easily. The crew mounted spare wheels on the front to increase surface area, and chains on the rear wheels to improve traction.

Have any vintage (pre-1975) photos you'd like to share? Email them in jpeg format to editor@arcmagazine.pub with a date the photo was taken (actual or approximate), a brief description (three or four sentences), and an email address where we can reach you for additional information.

PORT-A-TORCH®

The most versatile tool in your toolbox.

WORKING ON A WEEKEND PROJECT?

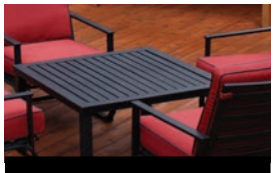
WHETHER YOU NEED TO CUT, BRAZE, WELD OR SOLDER, THE HARRIS PORT-A-TORCH® CAN HELP!

Turn to the HARRIS A LINCOLN ELECTRIC COMPANY Pros

HERE'S JUST A FEW THINGS YOU CAN DO WITH A PORT-A-TORCH®!


WELD A WROUGHT IRON FENCE


STRAIGHTEN A BENT PITCHFORK


REPAIR PATIO FURNITURE


FIX A WHEELBARROW


FIX A METAL TRICYCLE


HEAT A FROZEN LOCK


SOLDER WATER PIPES


HEAT AND BEND STEEL REBAR


CUT ANGLE IRON


CUT OFF A RUSTED BOLT

The Lincoln Electric Company
22801 St. Clair Avenue
Cleveland, OH 44117

Lincoln Electric's Multi Angle Magnetic Fixture can be used to accurately position and hold steel for tacking and other position. The compact size and light weight of these tools are ideal for tight spaces.

For more information visit www.lincolnelectric.com

LINCOLN ELECTRIC