WELDING JOURNAL

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Resistance Welding

Aluminum Storage and Preparation

IN THIS ISSUE: REMEMBERING BILL RICE ■ THE VALUE OF AWS MEMBERSHIP ■ NATIONAL DISTRICT OFFICERS

July 2025 | Volume 104 | Number 7

CONTENTS

EDUCATION INSPIRATION

12 Riding the Welding Rodeo
Learn how NWTC trains the next generation of welders
J. Draeger



On the cover: Applications Engineer Marlon Aquino uses a handheld weld monitor to verify a process on an inverter-controlled, direct-current spot welding machine. (Credit: AMADA WELD TECH.)

FEATURES

20 Remembering Bill Rice
The former AWS interim executive director, president, and Foundation chair is honored
K. Campbell

24 Monitoring Resistance Welding for Production Success
Recording waveforms and generating visual plots can uncover the root causes of problems in real time
M. Boyle and S. Shea

28 Your Next Hire May Be an AI Robot
AI-driven automation bridges the resistance welding skills gap and boosts industry competitiveness
J. Godgart

31 Understanding Aluminum Storage and Preparation
Discover why aluminum cleaning and proper filler metal selection and handling are critical to weld quality
S. Perrin

34 Summary of Changes to ASME *Boiler and Pressure Vessel Code* Section IX
A review of the updates that will become mandatory for new qualifications beginning next year
W. J. Sperko

DEPARTMENTS

5 Editorial
8 News of the Industry
15 RWMA Q&A
16 Product & Print Spotlight
38 Seminar Schedule
40 Coming Events
41 Society News
44 Tech Topics
50 Section News
70 Guide to AWS Services
71 Personnel
72 Classifieds
72 Advertiser Index

CONTENTS

July 2025 | Volume 104 | Number 7

WELDING JOURNAL RESEARCH SUPPLEMENT

217-s **Incomplete Fusion Defects and Deformation Behavior in GMA-DED of 316L and 316LSi**
This study evaluates the impact of systematically introduced IF defects on tensile properties of GMA-DED builds using austenitic stainless steel feedstocks 316L and 316LSi
D. Piccone et al.

231-s **Laser-Welded and Inflated Cold Plates for Battery Electric Vehicles: A Novel Approach**
The thermal-mechanical FEA modeling of laser welding and gas hydroforming of two AA3105 aluminum alloy sheets validates the behavior of the assembly by comparing simulation results to 3D scans of welded and inflated parts
A. Bobel et al.

246-s **The Effects of Residual Copper on Laser-Welded Low-Carbon Sheet Steels**
This work aims to assess the influence of residual copper content on the laser weldability and weld performance of automotive sheet steel
H. Geerlings et al.

257-s **Microstructure and Properties of Aluminum Alloy/Stainless Steel Gas Tungsten Arc Fusion-Brazed Joints**
A new groove design for GTAW fusion brazing to improve the apparent strength of the weld seam/stainless steel interface is examined
Y. Ma et al.

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The Value of AWS Membership



Carey Chen
AWS CEO and executive director

This marks my eighth editorial in the *Welding Journal*, and it also serves as my inaugural message as the executive director and CEO of AWS. Since stepping into this exciting new role in January 2025, I have reflected on nearly two decades of dedicated service as a volunteer, including seven years on the board of directors. Throughout my journey with AWS, I have often faced a pivotal question: "What is the value of AWS membership?" In this editorial, I aim to illuminate this value in a memorable and inspiring way, organized through the lenses of six key cornerstones: community, codes and standards, curriculum, certification, career advancement, and communication.

Community. At AWS, we proudly embrace the mantra of "joining people together." Our vibrant community consists of more than 60,000 passionate members worldwide, all driven by a commitment to excellence in welding. This volunteer-led organization spans 22 districts, over 150 sections, and more than 125 student chapters, unified by the efforts of over 3000 active volunteers dedicated to various committees. Supported by a skilled team of 160 staff members, our collective strength is rooted in collaboration and shared purpose.

Codes and Standards. With a legacy of over 350 welding codes and standards developed through volunteer consensus-driven efforts, AWS is a leader in setting benchmarks for quality and safety. These codes are not formulated in isolation; instead, they emerge from the expertise of dedicated volunteers within technical committees. Our flagship standards encompass structural welding, shipbuilding, automotive, aerospace, and many more, ensuring that industry practices are not only robust but also reliable.

Curriculum. Education is at the heart of what we do, and AWS is proud to offer a diverse array of training opportunities, including in-person seminars and virtual events tailored for today's learners. Offerings like Welding Fundamentals, CWI programs, and the SENSE Program empower welders to enhance their skills and knowledge, ensuring they are equipped for the industry's challenges. Moreover, we provide valuable instructional strategies to support welding educators, cultivating the next generation of welders.

Certification. Certifications are more than just credentials; they are a testament to a welder's expertise and commitment to quality. In a world where safety and compliance are paramount, certification ensures that welders meet industry standards and regulations. AWS offers a range of esteemed certifications, including the Certified Welding Inspector, Certified Welding Engineer, and many others, all designed to elevate professional standards and drive excellence across the welding industry.

Career Advancement. The age-old adage "learn a trade and you will never go hungry" rings truer today than ever. As we project a need for an average of 82,500 welding jobs to be filled annually across the United States for the foreseeable future, AWS is deeply committed to fostering career growth. Through the AWS Foundation's initiatives in career awareness, scholarship programs, and institutional grants, we are laying the groundwork for a prosperous future in welding, ensuring that talent is properly nurtured.

Communication. Staying connected with our members is crucial. We engage through various mediums, from in-person interactions at meetings, conferences, and technical committees to digital outreach on our websites and social media platforms. Our commitment also extends to traditional periodicals like the *Welding Journal* and newsletters, ensuring that every member receives timely and relevant information.

In summary, the value of AWS membership is immense. Welding plays a crucial role in our economy and the broader manufacturing sector, and we are dedicated to delivering diverse resources and opportunities that cater to every member. As we look to the future, I am energized by enhancing the value of our membership even more. Together, let us shape a brighter tomorrow in the welding industry. WJ

"The value of AWS membership is immense. Welding plays a crucial role in our economy and the broader manufacturing sector, and we are dedicated to delivering diverse resources and opportunities that cater to every member."

BY JIM DRAEGER



To help bridge the shipbuilding workforce gap, NWTC received a $579,000 U.S. Navy grant to launch Welding Rodeos and train the next generation of welders.

Riding the Welding Rodeo

Northeast Wisconsin Technical College's event supports the shipbuilding workforce by training new talent

Welding is a cornerstone of many critical industries, from construction to shipbuilding, yet finding qualified welders has become increasingly difficult. The urgency to recruit, train, and retain new talent has become a national conversation, and institutions like Northeast Wisconsin Technical College (NWTC), Green Bay, Wis., are stepping up to meet the challenge, developing solutions to address the workforce gap while fostering collaboration between education, industry, and communities.

Wisconsin, home to six of the Great Lakes' eight shipbuilders, is at the heart of this challenge. Faced with a need for skilled workers to meet rising demand, the shipbuilding industry has turned to long-time partner NWTC for innovative solutions. For nearly 100 years, the technical college has worked closely with the maritime sector, providing tailored training for shipbuilders and supporting workforce development to grow the industry.

Recognizing the growing need for skilled welders, the Department of the Navy's Science, Technology, Engineer-

ing, and Mathematics Education (STEM) and Workforce Program awarded NWTC with a $579,181 grant. Mirroring the success of similar events through Bellingham Technical College in Washington state, NWTC took this grant opportunity to organize the Welding Rodeo, an initiative designed to attract and train a new talent pool and bridge the workforce gap in the shipbuilding sector.

Over the course of three years, the technical college will host a series of events across its campuses, which are near Fincantieri Marine Group shipyards and many other influential welding employers. Kicking off in the fall of 2024, the Welding Rodeo has already demonstrated success in engaging the community, introducing new audiences to the welding industry and building strong career pipelines for the future workforce.

This Ain't My First Rodeo

Technically, it was the first rodeo — just not the kind you'd find on the western frontier. Cowboys and cowgirls swapped lassos for welding torches; wore welding jackets instead of plaid pearl-snapped shirts; and corralled hundreds of community members to spark curiosity, creativity, and engagement around the world of welding.

At the heart of the event was an eight-hour welding competition, during which participants of all skill levels teamed up to transform scrap metal into stunning artistic sculptures. Later that day, the sculptures were auctioned to raise funds for student scholarships in NWTC's welding program.



The event featured an all-day team competition turning scrap metal into art, with sculptures auctioned to support NWTC welding scholarships.



Participants sparked community interest by showcasing the creativity and skill at the heart of welding.

The event was a community effort in every sense. High school students formed teams to compete in the welding competition while local welding artists participated individually or coached younger participants. Employers played a key role by donating scrap metal and prizes, hosting interactive welding demonstrations, and engaging with attendees.

The atmosphere was lively, with local food trucks serving meals and a STEM career fair connecting job seekers with employers. Community members came to spectate, cheer on participants, and take part in the auction. The day was a resounding success — multiple attendees left with job offers, and nearly $10,000 was raised for scholarships.

The impact was immediate and profound, bridging education, industry, community, and opportunity. The event demonstrated that welding is not just a trade — it's a creative, collaborative, and rewarding career path.

This is what the Welding Rodeo is all about: a holistic approach that brings stakeholders together to raise awareness about welding in fresh, accessible ways. Visual and hands-on experiences play a critical role in career exploration, and events like this make the profession come alive. They go beyond technical jargon, helping the audience envision themselves in the field while showcasing the versatility and opportunities a career offers.



Hazel Knutson with her grandmother, who was a braze welder during World War II.



Knutson in the welding lab during her time at the Welding Rodeo.

Sparking Future Trailblazers

For 18-year-old Hazel Knutson, welding isn't just a career choice — it's part of her family's story and a passion she's been mastering over the years. Now a graduate from NWTC's welding program, Knutson started her journey into the trade during high school when she discovered her love for welding through an introductory course. Encouraged by a teacher who quickly recognized her talent, Knutson felt her interest deepen, fueled by the legacy of her grandmother, a braze welder during World War II, and her father, who is also a welder.

Knutson participated in the Welding Rodeo, where she mentored a team of students from Marinette High School, helping them secure first place in their category. For Knutson, the competition was about more than winning. She valued the chance to connect with fellow welders and network with local employers.

After graduation, Knutson plans to build her career in gas tungsten arc welding, drawn to the challenges and variety it offers. She has clear priorities when it comes to choosing a future employer.

"I look for variety in the type of work — I don't want to do the same thing every day. A clean and safe shop environment is also really important. Lastly, I rely on word-of-mouth and college tours to get a feel for potential workplaces," she shared.

When asked how schools and employers can better attract young people to welding, Knutson stressed the importance of hands-on opportunities. She encouraged schools to implement shadowing programs, organize visits to technical colleges, and host events like the Welding Rodeo.

"Events like these are amazing for showcasing what welding is all about," Knutson said. "They're great for younger generations because they show both the creative and practical sides of the trade. I hope there are more events like this in the future, maybe even for other industries, too."

Get in the Saddle

The need for skilled workers in welding is a challenge for industries to overcome, and one that will remain for at least the next decade. Old recruitment methods and traditional paths toward a trades profession only go so far in recruiting the next generation. There is a need to create a spectacle, generate excitement, and draw attention like the welding rodeos do. As industries and the future workforce evolve, it is essential to adapt and build upon partnerships to keep pace with changing demands and support the next generation of skilled workers. So, hold on tight and saddle up for the thrill of the ride. WJ

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For aluminum applications, 4043, 4943, and 5356 are used in over 85% of all aluminum weldments.

BY SETH PERRIN

Understanding Aluminum Storage and Preparation

Dry, properly cleaned aluminum is essential for quality welds

As many welders can attest, welding aluminum is a different ball game than welding steel. With its low melting point but high thermal conductivity, aluminum can go from solid to liquid very quickly, catching both beginners and seasoned welders off guard during the welding process. Practice definitely helps when welding aluminum, but proper material prep and equipment can significantly ease that steep learning curve.

Familiarizing Yourself with Aluminum's Differences

For welders who are used to handling steel, aluminum can accurately be described as a material that's the complete opposite. It's lighter and softer and has a lower melting point (approximately 1200°F), which means that once it heats up, it can stay hot and easily lead to burn-through. It also requires 100% argon (or an argon/helium mix) for arc stability — another significant departure from what's used for steel.

As a result, high-quality welds are far more difficult to achieve on aluminum. While the metal is mechanically different, another unique aspect of aluminum is that it develops a tough oxide surface film, which can lead to quality issues such as porosity and incomplete fusion or penetration, all of which can compromise weld quality. The oxide layer melts at a much higher temperature than the base aluminum (approximately 3700°F), so operators either need to set the welding parameters to break the oxidation, creating a hotter pool to burn through that layer, or, preferably, clean and prepare the base metal prior to welding.

Cleaning Aluminum Is Critical

Oxide prevention is key to minimizing how thick it forms on the metal. The most important thing to remember when handling aluminum is to keep it as dry as possible. An excessive presence of moisture will contribute to an increasing thickness of the oxide. One way to mitigate this

issue is by storing metal vertically, which allows water to run off, reduces the risk of condensation, and promotes airflow. Additionally, leaving gaps between stock materials helps further improve ventilation and minimize moisture retention. Typically, more humid states are at a disadvantage when handling aluminum, making proper storage even more important.

The most common approaches to preparing aluminum involve using stainless steel brushes, aluminum-specific grinding discs, or an aluminum-specific chemical cleaner to remove the buildup. Oxides can re-form quickly when exposed to oxygen, so the workpiece should always be cleaned right before welding occurs.

The level of cleanliness and metal preparation required for welding directly correlates with the desired weld quality. In critical industries such as military, aerospace, and naval applications, these factors are closely monitored to ensure compliance with stringent standards and performance requirements. Suitable preparation before welding is especially important when fabrications must meet stricter weld quality requirements of manufacturing codes, such as AWS D1.2, *Structural Welding Code — Aluminum*, the code for aluminum that provides the blueprint for welds in structural applications. The more prescriptive the requirements are, the more time and prep should go into cleaning the workpiece.

Proper Filler Metal Selection and Handling Promote High-Quality Welds

As with any welding, the filler metal chosen needs to meet the characteristics of the base metal and its intended application. For aluminum applications, 4043, 4943, and 5356 are used in over 85% of all aluminum weldments. 4043 is a popular aluminum/silicon filler alloy for general-purpose welding applications. The added silicon lowers the melting point and improves fluidity, reducing the risk of hot cracking, and provides smooth and consistent welding performance.

4943 is a heat-treatable, high-strength aluminum filler metal that offers the welding ease and advantages of 4043. Unlike other alloys, it does not rely on base metal dilution to enhance weld deposit strength. Additionally, 4943 welds produce minimal smut and distortion, ensuring cleaner, more precise results.

5356 takes everything up a level. It's preferred for anodized color matching, provides better feedability through the welding gun (twice as stiff as 4043 and 4943), and has higher strength, ductility, and toughness.

Selecting the right filler metal is likely pretty easy, but maintaining its integrity is key. The most important aspect of aluminum filler metal storage and prep is that moisture must not be allowed to come into contact with the product or packaging because it can significantly affect product performance. Sources of moisture include dripping water, condensation, and excessive humidity.

Wires should be stored in a dry, enclosed environment and, preferably, at a constant temperature with minimal fluctuations to prevent them from cycling through dew points. If the filler metal is moved from colder to warmer environments, it must be allowed to stabilize thermally in the welding environment for at least 24 hours prior to welding. If not acclimated, condensation can form directly on the wire, creating hydrated oxide on exposed surfaces and causing weld discontinuities. To assist customers in navigating this potential issue, dew point charts are available to help determine when condensation may form on filler metal (see Table 1). If the filler metal temperature falls below the dew point, as indicated by the intersection



Different than welding steel, aluminum requires the right material prep and equipment to yield quality welds.

Table 1 — Dew Point Temperature Chart

Air Temp. (°F)	Relative Humidity %									
	100	90	80	70	60	50	40	30	20	10
110	110	106	102	98	93	87	80	72	60	41
100	100	97	93	89	84	78	71	63	52	32
90	90	87	83	79	74	68	62	54	43	32
80	80	77	73	69	65	59	53	45	35	
70	70	67	63	59	55	50	44	37		
60	60	57	53	50	45	41	35			
50	50	46	44	40	36					
40	40	37	34							
32	32									

of the welding environment's air temperature and relative humidity, condensation will occur. This can lead to weld discontinuities and quality issues. Proper storage and handling are essential to prevent moisture-related defects.

Other Considerations for Aluminum Welding

While not strictly required, a push-pull welding gun is recommended for aluminum welding because of aluminum filler metal's low columnar strength. The wire is unable to resist buckling or bending when force is applied, and this intolerance to being pushed, especially over longer distances, easily causes tangling or bird nesting inside a standard wire feeder. A push-pull gun mitigates this issue because it feeds the wire from both ends (one motor at the spool and one at the gun), ensuring a smoother, more consistent feeding. The push-pull system also enables longer cable lengths without wire feeding problems, whereas standard gas metal arc guns would struggle to feed aluminum wire over long distances.

A push-pull gun mitigates many feeding issues, but keeping an eye on drive roll tension is also important. The driver tension should be between 1 and 2 to help ensure the wire isn't restricted. Otherwise, the wire can be inhibited from twisting naturally as it's going through the system. When that happens, the wire will slowly work its way back to the drum and knot up, creating a time-consuming problem to fix.

The wire pathway is just as important. Whether using 0.035- or 1⁄16-in. wire, smooth feedability depends on a clean, debris-free liner and a torch cable kept as straight as possible to minimize resistance. Additionally, inlet guides at the back of the feeder and between the drive rolls must be properly aligned and nonmetallic. With drum packaging delivery systems, attention to the conduit pathway is even more critical. Longer, winding paths from the drum to the feeder increase resistance and restrict the twist in the wire from exiting the system. To ensure smoother feeding and reduce potential issues, it's essential to minimize 90-deg turns and keep the pathway as straight as possible.

Unlike steel, where certain welding fundamentals can sometimes be overlooked without major issues, aluminum welding demands precision. Successful welds depend on proper drive roll tension, a clean and debris-free liner trimmed to the correct length, a properly adjusted spool brake, and a contact tip free from excessive keyholing, along with maintaining cleanliness in the feeder and base material.

Ending Thoughts

Welding aluminum can be complex, but with the right base knowledge, preparation, and equipment, it becomes much more manageable to navigate the challenges effectively. WJ

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