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At the American Welding Society (AWS), we are actively following the Novel Coronavirus (COVID-19) outbreak. The welding and fabrication industries have been determined to be an essential business, especially as it relates to repair and maintenance of key infrastructure. The content of the August 2020 issue of the Welding Journal is intended to be accurate when published, but we recognize that we are in a rapidly changing situation. For AWS’s official statement on COVID-19, as well as the latest updates and frequently asked questions, please visit aws.org.
Crack open the 8th edition of the American Welding Society’s (AWS’s) D1.5, Bridge Welding Code, and you’ll find the names of the individuals who worked to publish this new edition on schedule in 2020. These volunteers conscientiously carved changes into shape — addressing ballot comments, questions, and negatives from five AWS and American Association of State Highway Transportation Officials (AASHTO) committees — assisted by dedicated AWS staff.

Running the ballot gauntlet may sound excessive, but the process serves our community well. These diligent steps ensure that scores of professionals from various spheres of the bridge welding world review the provisions and contribute their perspectives. Comments come from academia, owners, designers, fabricators, inspectors, erectors, and material and equipment suppliers.

Sixty-two ballots and thousands of comments later, highlights include the following:

**Organization.** The “References” and “Terms and Definitions” clauses are pulled forward and are now Clauses 2 and 3. These moves improve the consistency of D1.5 with other AWS Standards. As a result, all clauses beyond Clause 1 have new numbers in 2020.

**Less “unless approved by the engineer” language.** This phrase is peppered through the code to remind engineers they have flexibility regarding what they accept under the code. However, this phrase is redundant with Clause 1.1.2, which already makes this clear. Such adaptability is needed to address the great variety of unusual situations that occur in bridges and to facilitate innovation. Given the explicit license granted by 1.1.2, the “unless approved by the engineer” phrase is not needed elsewhere.

**Approved materials.** Previously, D1.5 was approved for materials in specification ASTM A709 (AASHTO M270). However, this is not suitable because changes to A709 (M270) outpace changes to D1.5. Instead, the 2020 edition calls out specific grades as approved (see Clause 1.2.2).

**Finishing.** D1.5 has often used process-oriented terms for finishing, but the process doesn’t matter provided the desired condition is achieved. For example, “mill-to-bear” conditions don’t necessarily need to be milled. Hence, many (but not all) instances of “grind” and “mill” are changed to “finish” in 2020.

**Base metal preparation for welding.** Changes improve the consistency of D1.5 with other D1 Standards and reduce ambiguities, particularly regarding mill scale and rust. The code is no longer silent about welding over coatings; except for on tension joints and girder web-to-flange joints, this practice is now allowed, provided the fabricator demonstrates that such welding does not compromise weld quality.

**Tack weld remelting and broken tack welds.** The code has always allowed tack welds to be made without preheat if the tack welds are fully remelted by final welding. The 8th edition now has a required means of demonstrating this remelt. Also, language was added to clarify tacks that break in advance of welding do not necessarily have to be fixed, thus allowing welding to progress and avoiding unnecessary starts and stops.

**“Flaw” is out.** By definition, flaws are discontinuities that are undesirable but not necessarily rejectable. D1.5 is concerned with discontinuities that are either acceptable or not (i.e., defects). The term “flaw” is subjective; just how undesirable are the discontinuities called “flaws?” To avoid this subjectivity, the term “flaw” is now avoided.

**Magnetic particle inspection (MT) lots for short welds.** The new code allows a “lot basis” alternative for MT of welds under 1-ft long, whereby assembled components can be grouped, and then only one-in-ten members need be tested. For example, if a bridge has 40 main-member cross frames, the fabricator now has the option to only MT four entire cross frames.

**Digital radiographic testing (RT).** In perhaps the most momentous change to the code, digital imaging is now explicitly allowed for RT in D1.5. This brings the code up with actual practice; fabricators have been using digital RT for many years, for many bridge owners.”

Ronnie Medlock
Chair, DJ Subcommittee, and Vice President – Technical Services, High Steel Structures LLC

“In perhaps the most momentous change to the code, digital imaging is now explicitly allowed for RT in D1.5. This brings the code up with actual practice; fabricators have been using digital RT for many years, for many bridge owners.”

Joining Spans with the New Bridge Welding Code

Use the new code — available for purchase at pubs.aws.org — to ensure your bridge work is state of the art. But don’t get complacent: Another edition will be here before you know it. See you again in 2025. 

“Weave and stitch over the vast, diverse landscape that is the bridge welding world. As always, please be sure to seek advice whenever possible, as every project is different. Be fearless. Be innovative. Be bold.”
The State of Welding Education during COVID-19

As the world continues to struggle with the COVID-19 pandemic, we, at the National Center for Welding Education and Training (Weld-Ed), are beginning to see some patterns in the delivery methods and limitations within welding education. These patterns can be seen in the analyzed data from a survey we conducted that was sent to welding instructors in April 2020.

The survey had a total number of 333 respondents, with 291 fully completed surveys from nearly every state within the United States. The information that follows is a summary of the key findings from the survey.

Background

Welding instructors want the best possible education and training for their students. With the severe restrictions imposed to mitigate COVID-19, welding instructors, as well as all career and technical education (CTE) instructors, are thrust into situations requiring innovation and adaptation.

Since the start of the pandemic, online learning has become the standard for delivering welding education. For some courses, notably those without a laboratory practice component, the online format seems to be acceptable. However, as revealed by the survey data, an online format often poses serious restrictions to content delivery and student success.

State departments of health and the Centers for Disease Control and Prevention (CDC) continue to shift and evolve guidance for returning to classrooms and laboratories. But to assure quality welding education and training, a return to classrooms and laboratories is necessary.

In a letter to the U.S. Assistant Secretary of Labor John Pallasch, President and CEO of the American Association of Community Colleges Walter Bumphus states, "It became clear that while community colleges had the capacity to convert courses to online instruction, they also had reservations about doing so and about the negative impact it would have on training programs across multiple industry sectors. Online learning is appropriate for certain courses and it is an effective tool for learning. However, the universal application of it in CTE and RTI [related technical instruction] programs does not remove the need for face-to-face labs and experiences that must be conducted in person."

Certainly, the need for face-to-face instruction is obvious for many CTE courses, especially skill-building courses in welding. However, what is lost in the discussion about the need for practice to build requisite skills in many CTE courses is the lack of understanding about student learning preference and the need for socialization. Welding students are kinesthetic learners. Online learning tends to cater to the opposite student-learning preference of auditory and visual.

In addition, many educators continue to hammer on the need for “soft skills” as their students enter the workforce. Online learning provides minimal opportunity to communicate orally, practice teamwork skills, develop social skills, or exercise appreciation for various viewpoints. Although video conferencing and well-designed chat sessions border on social interaction, the participants remain isolated with a limited ability to express personal beliefs.

Many of the key findings from our survey indicate similar thinking by the welding education community. It is not enough to simply deliver welding and related theory; it is...
necessary to engage our students through thoughtful and meaningful interaction.

Brad Polanin, superintendent of the Riverton Community Unit School District in Illinois, in a letter to his students, parents, and the community, wrote, “Schools throughout the nation often focus our energy, attention, and efforts on improving academic achievement and standardized-test scores. After all, we are schools and we are here for teaching and learning. However, what often gets overlooked and unnoticed are the life lessons taught by staff members and peers. As with all people in society, students and teachers all come from differing backgrounds and differing experiences, all contributing to the experience of individuals. Experiences within a school can be good or bad, but they all are responsible for forming young lives that will sustain our future.”

During this time of turmoil, we must not lose sight of the diverse mission of welding, manufacturing, and career education in general. Assuredly, it is our responsibility to provide the best education and training to our students to prepare them for a successful career. But it is also our responsibility to provide our students with experiences that will prepare them for a successful life.

The following key findings and comments from the respondents of the survey may provide some suggestions for organizing and developing courses for an uncertain future. We hope you all stay safe and that the data and commentary offers some useful information to prepare for the fall semester.

**Key Findings**

At the time the survey was conducted (April/May 2020), 308 schools (93.3%) were closed as a result of COVID-19. Instructors taught in a variety of school settings, including universities (1%), community colleges (21%), technical schools (22%), high schools (52%), and industry (1%). The survey also revealed 83.3% of the instructors were providing online instruction. However, only 66 respondents (21%) indicated that student participation in class was between 90% and 100%. Eighty-nine respondents (28.9%) indicated that less than 50% of their students were participating.

The predominant video conferencing platform was Zoom with 42.5% respondents. However, Google platforms (Hangouts, Classroom, Meetings) were also commonly used. Many of the respondents confused learning management systems (LMS) with video conferencing platforms. Yet, 40% of respondents specified that a LMS was used for part of the instruction, with Canvas used by 23.5% and Blackboard by 11%.

The limited use of an LMS is supported by understanding the development of the type of online content delivered. Fifty-six percent of respondents said the online welding content was instructor-developed content, or instructor-developed with the use of YouTube content. Only 26.6% of instructors used commercially-developed products.

Only 5% of respondents indicated their students were prepared through online and in-class instruction to enter the workforce. About 79% of the respondents signified their students were only partially prepared or not prepared well (24%) to enter the workforce.

The limited use of an LMS or video conferencing platform is directly related to the difficulties of online instruction for students. For example, 55.5% of the respondents said their students did not have access to Wi-Fi or the Internet, and 18% specified their students did not have access to a computer.

Although 93.3% of the respondents reported their school was closed, 20% specified they were continuing to teach modified laboratory classes (79.5% were not teaching labs). Some of the methods used to continue laboratory teaching included using mock-ups of gas metal arc welding guns, YouTube videos, at-home practice with pictures of progress sent to the instructors, aerosol cheese and crackers, and the use of videos recorded in the school lab prior to closing.

Few respondents showed a firm date for restarting classes. About 15% suggested June 2020 for potential opening, but 53% implied the fall semester would likely be when classes resume, and 21% were unsure when classes would start.

No clear strategy emerged for social distancing in the laboratory. Only 20% of the instructors said the laboratory would be limited to less than 14 students with 65% of the instructors indicating classes would resume with full student capacity or were unsure how many students would be allowed in the laboratory.

The majority of the instructors affirmed their school would rely on state guidance (60.2%) for reopening, with 24.3% relying on local or school guidance. Only 6% indicated they or the school was following the CDC guidelines. However, about 49% of the instructors observed there was a strategy for disinfecting personal protective equipment (PPE). Yet, 47.2% of the instructors stated it was unknown who was responsible for disinfecting PPE. Furthermore, 48.4% of instructors did not know if additional PPE would be required, and 51.8% of instructors did not have a plan for social distancing.

During the time schools have been closed, only 26.7% of instructors said they participated in any information-sharing websites, chats, or webinars. But 68.6% of instructors said they would likely or somewhat likely participate in information sharing after returning to the classroom.

Finally, we asked about the resources that would be most beneficial to help improve welding instruction. The responses were varied, but a few of the common suggestions included a repository for welding lesson plans, listing of online resources, guidance for reopening schools, and, of course, additional funding.

**Key Recommendations**

With respect to the instructors who participated in the survey, the first key recommendation is obvious, resume face-to-face classes with the appropriate protection in place to allow for the safety of students, faculty, and staff. Because the instructors reported less than 50% of their students were participating in the online class format and 79% of the instructors reported their students were only partially prepared or not prepared well (24%) to enter the workforce, resuming face-to-face classes is critical to the preparation of our future workforce.

Underlying the obvious recommendation is the realization that welding students and likely most CTE students require instruction and motivation from interaction with instructors. However, the data also tends to show that many of the instructors were not prepared for or had not received any instruction to allow for successful online teaching.

Further, the lack of reliable internet accessibility — with 55.5% of instructors reporting their students did not have access — suggests insufficient infrastructure. The survey did not seek to determine the socioeconomic condition of
the schools from which the data was gathered. Therefore, no generalizations can be made about the reasons for the lack of internet access. What can be said, however, is that many schools were profoundly unprepared for the shift to online instruction.

Thus, the second recommendation is equally as obvious as the first: Develop a strategy to ensure internet access for all students. Whether the use of school-sponsored hotspots, or community developed hotspots, all students need reliable access for continued learning during potential future lockdowns. Schools need to determine the feasibility of mobile hotspots or the possibility of lending students cellular-ready equipment.

The third recommendation concerns the instructors: Provide professional development to prepare instructors for online teaching. Many colleges and universities provide online teaching courses, leading to an online certification for instructors. Face-to-face classes cannot simply be transferred to a LMS without thought development of objectives, learning activities, motivation strategies, assessment of progress, and evaluation methods.

The fourth recommendation is standardized guidance. The instructors reported there was little guidance from federal and local government or school districts for reopening schools. A standard for social distancing, laboratory population, disinfection (including responsibility for disinfecting equipment), required PPE, and student movement needs to be developed and enforced.

A safe learning environment is critical to effective learning. Specific recommendations for class size, student spacing, disinfecting frequency, instructor protection, welding demonstration strategies, and perhaps student testing should be written in plain language and as simple bullet points. Recommendations for safe operation of laboratories during the pandemic should be as visible as the general safety rules posted in nearly every welding laboratory.

The final recommendation is for organizations to develop content for welding instructors. As welding content materials are produced and professional development courses are developed, design the materials for use in the classroom and online. Some additional student learning objectives, strategies for both in-class and online motivation, learning activities that may easily be adapted to an LMS, listings of robust online resources, and secure evaluation methods are a start.

Conclusion

As Weld-Ed enters the next phase of education with uncertainty, preparation is the key to success. Our survey shows we were all unprepared for the dramatic shift in content delivery. However, as we continue to struggle with the possibility of future disruptions to the education process, we need to be adaptable, innovative, and flexible. Welding education will have to adapt to the possibility of decreased time in welding laboratories. Therefore, effective and efficient learning activities will be critical.

No virtual welding system, at least currently, will take the place of in-laboratory and on-the-job practice. But adaptability through the development of hybrid welding courses will help to improve the throughput of our students and prepare them for a successful career.

Understanding of the student learning process, effective use of distance learning technology, sharing of educational resources, and continuous improvement through professional development are all needed to ensure welding education remains a vigorous contributor to the economic and social success of our students and the United States.

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The National Center for Welding Education and Training (Weld-Ed) is a national partnership between the welding and materials joining industries and the nation’s community and technical colleges and universities that is dedicated to expanding the role and pipeline of welding technicians in industry. Weld-Ed was funded in 2007 as an Advanced Technological Education National Center by the National Science Foundation. Weld-Ed’s website can be found at weld-ed.org.

AWARDS Guidelines for Submitting a Welding Journal Feature Article

Have you ever thought about writing a feature article for consideration in the Welding Journal? If so, our staff stays on the lookout for original, noncommercial, practical, and hands-on stories. Take a look at our editorial calendar — available as part of the American Welding Society’s Media kit at aws.org/wj — to see what topics will be highlighted in future issues as well as the editorial deadlines. Potential ideas to focus on could include a case study, recent company project, and tips for handling a particular process.

Here’s an easy breakdown of our guidelines:

- The text of the articles should be about 1500 to 2000 words and provided in a Word document.
- Line drawings, graphs, and photos should be seen as high-resolution JPG or TIFF files with a resolution of 300 or more dots per inch.
- Plan on about one figure for every 500 words, and provide captions for every image. Also, if a nice lead photo is available, please include it for review.
- The authors’ names, along with the companies they work for and their positions, should be listed.

If you’d like to discuss a particular idea or email a submission for evaluation, please contact Managing Editor Kristin Campbell at kcampbell@aws.org.
HEY CWIs!
DONT JUST QUALIFY WELDERS, CERTIFY THEM

CWIs with elevated skills in specific welding code sections are constantly in demand and usually better-compensated. Endorsements reflect your demonstrated additional knowledge, skill, or ability and are added to your certification credentials.

New Endorsement for 2020:
Welder Performance Qualifier
The all-new AWS Welder Performance Qualification Endorsement officially puts the power to certify welders in your hands. Getting this endorsement satisfies not only an “Alternate Qualification” requirement for SCWI certification, but earns you renewal PDHs and/or CEUs.

Show your boss or your clients that you’re approved to qualify welders for certification according to AWS Standards.

To learn more, visit aws.org/cwi_endorsements
Does becoming a Certified Resistance Welding Technician (CRWT) capture your attention? If so, you’re in luck, as this certification is now being offered.

The CRWT credential validates that the bearer has demonstrated knowledge about resistance welding (RW) principles, processes, and equipment through a combination of education, experience, and examination. It was co-developed by the American Welding Society (AWS) and the Resistance Welding Manufacturing Alliance (RWMA).

In the May 2020 Welding Journal, RWMA Chair Don DeCorte wrote the following in his Editorial:

“The CRWT gives us a standard we can use to evaluate resistance welding staff. It can help companies determine which of their new hires or current employees are qualified to operate and maintain their equipment . . . By taking and passing the CRWT exam, you can proudly say and prove you are proficient in the knowledge of resistance welding processes and application.”

For more information, including whether or not you qualify, visit aws.org/certification/page/certified-resistance-welding-technician.

For even more inspiration, continue to read this article that profiles four CRWTs who detail their backgrounds, why they pursued the credential, the benefits/challenges with RW, as well as future thoughts.

Like Father, Like Son — Aaron Bacon

“My father [Dave] got me into resistance welding,” Aaron Bacon fondly recalled. That was 18 years ago.

Unfortunately, Dave broke his ankle at that time and needed help to teach his RW course. Son Aaron stepped up to the plate, and also found his calling — Fig. 1.

Skilled trades employees typically took a four-day course, and production personnel took a half-day course.

“On the last day of the week, we would go out on the floor to assist with any problems or concerns on the assembly lines,” Bacon remembered.

Eventually, his father took a full-time position as a welding engineer.

“I continued the teaching and consulting business on my own, traveling around the country and even to Canada,” he said.

Then Bacon changed gears a bit and accepted a position as a welding technician at an automotive supplier. He learned to operate robots, among other tasks. But in late 2008, during the Great Recession, he was laid off.

Bacon returned to the industry as a welding engineer at Quality Metalcraft/Experi-Metal Inc. This Livonia, Mich.-based automotive supplier focuses on stamping and welding. He’s currently the senior welding engineer.

“Some days, we have made over 200,000 spot welds,” Bacon said. “I’ve been at the company for over five years, and we are continuing our growth into new welding technology.”

He was encouraged to take the CRWT exam for different reasons.

“Resistance welding is my career. I love what I do, and I love to learn more,” Bacon emphasized.

And upon hearing about this new certification, he jumped at the chance.

“Why not have another feather in
my cap?” Bacon said. “The CRWT is a great way to get people to learn more about the mysteries of resistance spot welding.”

His additional thoughts on the process are as follows: “I believe the main benefit of resistance welding is the cost of each weld. It costs just fractions of a penny to make a weld. The speed of which a weld is made is another benefit. This makes processing assemblies more profitable.”

On the flip side, “The biggest challenge in resistance welding is going to be the new advances in steel and aluminum. The new Gen3 materials are still being researched.”

Bacon just earned the CRWT credential, yet feels there is potential to use it to advance his career in the future.

“With the new CRWT certificate out there, I believe there will be more resistance welding courses readily available,” Bacon said. “This will make it more economical for the designers who are designing the welded assemblies to get the training and the understanding of why there are limits to the process. I am already seeing the advancements in monitoring the weld process down to the microsecond. This monitoring will help better understand the issues and be able to respond to them or totally eliminate them all together.”

**Valuing Real-World Resistance Welding — Chase Einspahr**

Of obtaining the CRWT credential, Chase Einspahr said the following:

“It has instilled a sense of pride in me, further confirming my place amongst this fascinating craft called resistance welding. I do predict gainful advantages ahead after earning the credential and would absolutely recommend those seeking opportunity in the resistance welding field to pursue a CRWT as well.”

His introduction to the process dates back to 2012, as an operator for Kawasaki Motors Mfg. Corp. This passenger rail car builder, located in Einspahr’s hometown of Lincoln, Neb., is where he still enjoys a successful career — Fig. 2.

Armed with an associate’s degree in welding, he started arc welding on the end structures of cars. But when the pitch cycle decreased, he took on other tasks, such as assembling the sides of cars by spot welding the doors. After a year, he began programming the automated one-side spot welding equipment, and progressed to leading the initial set up of machine qualification and scheduling certification for one of the company’s projects. Afterward, he assumed a role in production engineering.

To become proficient, Einspahr said he “attended RWMA school at FABTECH in 2014 and extensively researched the process.”

Today, his duties include managing the testing process and personnel, preparing and submitting contract records, investigating issues, and troubleshooting equipment. Einspahr has also been involved with setting up four major projects; he’s preparing for two more, which extend to roughly 40 different RW machines (spot and seam).

In addition, Einspahr is an AWS Certified Welding Inspector. He uses that skill set to manage weld quality within rail cars.

Seeking another certification made sense. “I was very much interested in the CRWT certification as it was unfolding and ultimately obtained my certification through the beta testing process in 2019,” Einspahr said.

Studying the Resistance Welding Manual, received from previously attending the RWMA school, was helpful.

“I did appreciate many of the questions on the test that pertained more to the real-world application of the process, opposed to regurgitation of text from a book, to which I feel I knew well,” Einspahr added.

He believes the pluses of RW are well-known by those who utilize the process, yet probably not fully realized by those who don’t.

“Some advantages would include being very economical in terms of efficient weld times, not requiring additional materials, such as filler metal or gas, and being very repeatable, which is certainly desirable from a quality standpoint,” Einspahr said. “Obviously, as with any welding process, there will be some drawbacks in terms of investment in equipment, usability for certain conditions, and possessing the technical knowledge to implement the process. However, these are undeniably outweighed by the countless benefits to be gained with the process in a manufacturing or fabrication setting.”

In his opinion, one of the most important challenges would be controlling the process after initial testing has been completed.

“Resistance welding can be very repeatable, so long as the variables remain within criteria of the initial setup. Standardized training and auditing of operators, as well as routine testing of equipment and procedures, is of paramount importance to ensure the integrity of welds being made,” Einspahr said.

For what’s ahead in RW, he thinks it is difficult to say for certain. “I feel that the future of resistance welding is bright, and I’m not just talking about expulsion,” Einspahr joked. “So many things you would never think of are already held together using this wonderful process, and as the knowledge and understanding of resistance welding continues to expand, so too should its place in the welding world.”
Veteran Perspective —
Mike Gaskill

As manager in the Research & Development Laboratory at the Taylor Winfield Technologies, Youngstown, Ohio, Mike Gaskill is responsible for testing and applying the process of RW for parts production machines — Fig. 3.

"In some cases, the process is well defined and all that is required is to supply potential customers with welded samples to their specified requirements. In other cases, the RW process is new or was not previously used, and the potential customer is seeking advice on the best way to join their material," he explained. He then instructs the customer on the best design approach and material joining process to reach his or her desired parts production goals.

Gaskill joined Taylor Winfield in 1998, after spending the previous decade working for a small RW equipment manufacturer. He started there part time while getting his degree in electronic engineering, in the mid-1980s. That manufacturer then hired him full time, providing him a very broad foundation on the process and equipment manufacturing. Gaskill recalls his early career experience as follows: "My initial duties were running automatic ‘screw machines’ making electrode caps." As his education progressed, he was moved into the controls department, where he started making wire harnesses and soldering printed circuit boards for weld controls, as well as assembling and testing of completed weld controls.

From his veteran perspective, he sees great benefits to the process compared to other joining methods, including reduced cycle time, no added filler material, and simple operation.

"In many cases, the welder [welding machine] can be setup by someone experienced in resistance welding, like a CRWT, and then run by a competent operator," he pointed out.

Gaskill said that in some cases, the RW process may not be considered as valid by those who have never been exposed to it. "On the other hand, some of the applications can be complex due to part geometry and thus necessitate complex tooling," he explained, and those with previous positive experiences with RW generally pursue these "difficult" applications because of the previously mentioned benefits.

Gaskill contends that the future of the industry will be driven by "continued improvements in the machine electronics" as they are made within the electronics industry. He also mentioned that changes in materials will trigger some changes, "as metallic components are replaced with polymer ones, and advances in other areas as materials develop and the need for fast and reliable joining are required."

Having earned his CRWT early this year, Gaskill believes the credential "helps to set one above others in the field. It helps to set a standard and thus gives employers and customers a means to gauge the quality of people." When asked what impact earning the credential has had in his career, he shared, "... it has given me recognition among my peers and a sense of accomplishment, as I am the first within my company to obtain it."

Finding His Niche —
Michael Stotts

Michael Stotts was first introduced to RW during his undergraduate years at The Ohio State University, where he ultimately attained his degree in welding engineering. His undergraduate research project studied weld defects that occur during RW of advanced high-strength steels in automotive manufacturing.

"At Ohio State, I was introduced to more welding processes than I even knew existed, but I really found my niche in resistance welding," Stotts asserted.

Soon after graduation, he took a position in the Erlanger, Ky., plant of OBARA Corp. USA, an established RW equipment manufacturer. The company evolved around the automobile industry, and its RW products are now used in car production lines all over the world. At the recommendation of his supervisor, Stotts registered for the exam, as the preparation necessary would involve setting a directed study plan to take a deeper dive into RW, and eventually gauge his knowledge on the subject.

"Studying was very straight forward," Stotts said, because AWS provides significant guidance when it comes to exam prep. This is in the form of AWS C1.5, Specification for the Qualification of Resistance Welding Technicians, and AWS QC20, Specification for AWS Certification of Resistance Welding Technicians, which cover the breadth and depth of the exam material, as well as a comprehensive two-day seminar in different locations that can also be customized to run on location at a facility.

"There were no surprises when taking the test. I was able to focus on the material that was heavily covered in the exam, and the content that I was not as familiar with," Stotts remarked. "AWS was able to get input from industry leaders as to what skills and knowledge is important for the resistance welding technician," he said. As a result, this new AWS certification sets the standard in the industry. Stotts went on, "AWS certifications are respected by both peers and employers, and show that you have the tools to effectively diagnose and repair resistance welding equipment."

With his new credential, Stotts considers himself ready to meet any challenges within the industry in his position of weld engineer — product development at OBARA.

He elaborated on what he considers the greatest benefits of the RW process: speed and efficiency. "Welds are able to be made in literally fractions of a second, and [RW] is ideal for high-speed manufacturing . . . in terms of energy input to energy consumed to make the weld."

He views the development of new
materials and competing welding processes as potential challenges. For example, Stotts shared, “With the ever-increasing demand for improved gas mileage, automotive manufacturers are continuously looking at new materials in order to make vehicles lighter,” and, therefore, new materials, such as higher strength steels and increased use of aluminum, pose some challenges. Also, he explained that other processes like laser welding or friction welding are becoming easier to automate and may be more cost effective.

In his opinion, the future of RW lies in advancing both the control and monitoring systems. “Being able to precisely control both the mechanical force and electrical current allows for extremely high weld consistencies” with new control systems that are able to use “electrical and mechanical feedback systems to adaptively make changes to both current and force during the weld sequence in real time.”

While traditional RW quality testing has focused on destructive testing of a small sample of welded parts as representative of every weld, new systems can “monitor the quality of every weld in real time and will allow manufacturers to ensure that every weld is to standard.” Stotts concluded that these important advances lead to higher quality manufacturing and ensured consumer safety.

**Parting Thoughts**

These profiles showcase professionals thriving in today’s RW industry. It is competitive and focused on high production, using costly and valuable equipment operated by skilled technicians and engineers. In addition, it is an evolving industry with a strong foundation for future growth and innovation.

The new CRWT credential was developed to establish a standard of qualification that is tested and creates a benchmark for the industry professionals. If you are, or employ, a welder, engineer, technician, skilled tradesman, supervisor, or in charge of quality control in RW operations, you can benefit from the validation of qualification that comes with earning the AWS CRWT certification.

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**Where to Find CRWT Exam Preparation and Training**

Resistance welding personnel must possess the knowledge and skills to safely and effectively set up, calibrate, operate, and maintain resistance welding equipment.

The Certified Resistance Welding Technician (CRWT) credential serves as an attestation of an individual’s mastery of resistance welding technology and fundamental concepts. To become a CRWT, prospective candidates must pass a timed, closed-book exam consisting of at least 100 questions. To ensure that CRWT hopefuls are prepared for the certification exam, the American Welding Society (AWS) has developed the following training options:

- **CRWT Exam Prep Seminar.** A comprehensive, two-day seminar taught by a resistance welding expert. The seminar covers the subject matter detailed in the Body of Knowledge for the CRWT exam, as well as real-world scenarios and discussion topics. Participants are provided with all the required books and a study guide that includes reference materials and practice exam questions. In addition, participants are granted instant access to 16 online modules to solidify their foundation of resistance welding fundamentals prior to attending the seminar.

- **On-Site Custom Training.** AWS can also bring the classroom to you. AWS sends industry experts and educators directly to your location or a site of your choosing and will develop tailored instruction to ensure your staff gets the pre-exam certification training they need efficiently and economically. Small or large class sizes are accommodated.

For more information, or to register for an upcoming seminar, please visit awo.aws.org/crwt.
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