DECEMBER 2019

INDUSTRY SPOTLIGHT: AEROSPACE

AMERICAN WELDER: GTAW AND SMAW

PUBLISHED BY THE AMERICAN WELDING SOCIETY TO ADVANCE THE SCIENCE, TECHNOLOGY, AND APPLICATION OF WELDING AND ALLIED JOINING AND CUTTING PROCESSES WORLDWIDE, INCLUDING BRAZING, SOLDERING, AND THERMAL SPRAYING.
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As both the American Welding Society’s (AWS’s) centennial year and my term as president come to a close, I am pleased to have this opportunity to share some highlights with you.

One of the big events this year involved the selection of our first class of Future Leaders (aws.org/futureleaders). The program is aimed at developing the next generation of AWS leaders and offers opportunities for early career members to attend two board of director (BOD) meetings. The two individuals chosen this year, Victoria N. Shekaste-hband and Mitchell R. Grams, participated in policy discussions, gained leadership skills, and connected with industry leaders.

In January, I attended a workshop for association leaders sponsored by the American Society of Association Executives™. We learned all of the societies/associations are challenged by the same issues we face at AWS, including an aging workforce and waning attendance at Section meetings.

The Transition Ceremony and Executive Committee Meeting took place at AWS World Headquarters in mid-February. After the ceremony, members of the Executive Committee served lunch to the entire AWS staff to express appreciation for their dedication and hard work. I also attended the WEMCO and RWMA meetings in Miami, Fla., where I gave a presentation and attended interesting talks on digital strategy and an economic update. In early April, I traveled to Tempe, Ariz., to attend the morning meeting of the Membership Committee. That same afternoon, I flew to San Diego, Calif., to attend the Annual Gala for Workshops for Warriors held on the USS Midway.

Our executive director resigned just before the spring BOD meeting to explore other opportunities. Previous Executive Director Ray Shook has returned to the position in an acting capacity. In addition, a new leadership training workshop for BOD members took place there for the first time. Shortly after, my wife Kellie and I attended the 72nd International Institute of Welding (IIW) Annual Assembly in Bratislava, Slovakia. I was honored to join the chair and vice-chair of the American Council of IIW at the general assembly, IIW’s version of a BOD meeting.

A search committee has been established for a new executive director and the process is well underway. I would like to acknowledge the committee members for their diligence and hard work. We hope to have a new executive director in place by the second quarter of next year.

The summer Executive Committee Meeting took place at the Seneca Resort in Niagara Falls, N.Y. The social highlight of the weekend was the Maid of the Mist boat ride, where everyone got soaked.

The 2019 Welding Summit in Houston, Tex., was well attended with more than 200 individuals and an impressive number of exhibitor tabletops. The conference organizers and AWS staff are to be commended for their outstanding efforts in making the event a real success. More recently, I returned from the GAWDA Annual Convention in Washington, D.C., where I was joined by AWS staff.

In addition to the meetings outlined above, I really enjoyed participating in many AWS Section meetings, taking plant tours, and visiting schools and universities this year. I apologize that, due to space limitations, I will not be able to list by name all of the district directors, Section leaders, and members who hosted my visits. I would like to thank all of you for making my visits successful. I had a lot of fun and am humbled by the tremendous respect for the office of the AWS president shown to me by everyone.

Before closing, it is important to provide a few quick updates from AWS World Headquarters. Despite issues with the economy and volatility of the stock market, AWS is financially strong. In addition, I would like to recognize the AWS Membership Department staff for helping Sections. Much of this effort is being spearheaded by Cassie Burrell and Darrill Gaschler; for example, Gaschler is now holding a free monthly webinar for Section leaders and members titled “AWS Section Solutions Conversation.”

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Back in January 1965, most American Welding Society (AWS) members who read the paper titled Electron Beam Welded Heavy Gage Aluminum Alloy 2219 likely didn’t know the author was a woman. It was written by Margaret W. Brennecke, the first female welding engineer to work in the Materials and Processes Laboratory at NASA’s Marshall Space Flight Center.

Her bio on the NASA website calls her “a true trailblazer in the field of aluminum alloys — a skill set critical to the success of the Apollo program.” Adding that she “spent her long career building large structures and breaking barriers in a previously male-dominated field.”

Born in Erasmus, Pa., she eventually earned a bachelor’s degree in chemistry from The Ohio State University. She followed that up with graduate work in metallurgy at the Carnegie Institute of Technology in Pittsburgh, Pa., the University of Pittsburgh, and the University of California in Los Angeles. She then spent 22 years as a research metallurgist with the Aluminum Company of America (Alcoa) Process Development Laboratory where she investigated new processes for using aluminum in large structures and developed new alloys.

She joined NASA in 1961. In a 2004 oral history interview conducted by NASA, she recalled her thoughts on the change in employment: “When NASA came into being, I was intrigued. I remember [President John Fitzgerald] Kennedy in May 1961 came up with a challenge to the moon before the end of the decade … I was thrilled with the prospect of being involved in this challenge, particularly with its ‘we will win’ leadership. I [had] been in Russia in 1958 and I wanted desperately for the U.S. to get ahead of the Russians in space. To me, here was our opportunity and I could be a part of it.”

It was World War II that provided the opportunity to move from chemistry to welding and alloy fabrication. The expanding wartime economy and shortage of male workers provided opportunities she seized upon.

She joined NASA as a welding expert at Marshall Space Flight Center. She had vast knowledge of aluminum alloys and gas tungsten arc and gas metal arc welding. According to NASA, “Throughout the Saturn era, Brennecke was called upon by center management to make critical decisions on the selection of lightweight high-strength metals and welding techniques for the huge Saturn stages. Specifically, Brennecke provided metallurgical engineering support for solving the problems of obtaining the required heat treatments, cold work, and metallographic structure leading to high strength and reliability in thick aluminum welds of cryogenic fuel tanks. She also contributed to the important research efforts leading to optimal thermal-aging treatments for those high-strength aluminum alloys.”

Despite her accomplishments, discrimination based on
her gender followed Brennecke throughout her career. In the NASA interview, Brennecke noted, “I had to work twice as hard, particularly when either of my immediate supervisors would interfere with what I was trying to do. They would give me an assignment and the next thing you know, they were playing some kind of a trick. You learn there is such a thing as survival. You learn how to go around or up or down.”

She recalled a specific instance when a higher-up tried to change her official job description from physical metallurgist to physicist. “This might sound stupid,” she said, “but he basically wanted to eliminate a position. By making me a physicist, [he tried to imply] I did not belong there and I sure as hell did not want to be a physicist.” She ended up going over his head and her title of metallurgist remained.

She credited her nickname “Hap” with helping to smooth the way because she could disguise her gender, especially in written reports and correspondence beyond the laboratory.

Her coworkers tended to call her Miss Hap — a cross between the formality of the times and the informality of the shop. It turned into a joke, with her hardhat labeled “MISHAP.” In the oral history, she recalled, “It was not appreciated by the safety inspector. He did not think that was funny at all.”

Following the Saturn program, Brennecke was assigned to Marshall’s Metallic Materials Division where she worked on metallic material and process selection and evaluation for Spacelab hardware and the solid rocket boosters for the Space Shuttle Program. In 1974, Brennecke brought her immense experience in the selection of high-strength steels, as a member of the committee responsible for rewriting the Military Handbook 5, the Metallic Materials and Elements for Aerospace Vehicle Structures — the most authoritative source for aerospace metals and alloys data at the time.

During an interview with the Marshall Star in 1962, Brennecke was asked, “How does a woman invade a so-called man’s world?” Brennecke’s answer: “Establish yourself on the basis of what you can contribute, not of the basis of being a gal.”

Margaret W. “Hap” Brennecke passed away in 2008.
3 WAYS TO MAXIMIZE YOUR MEMBERSHIP

1 CONNECT WITH OTHERS

- MemberNetwork AWS.org – Access our exclusive, members-only online network and enter an active online community of AWS members who share ideas, discuss technical concerns, and get input and support on welding-related issues
- Become actively involved in your local AWS Section activities
- Attend AWS-Sponsored events such as FABTECH USA, Mexico or Canada; Welding Summit, and others

2 ENJOY NUMEROUS DISCOUNTS

- Receive discounts on technical standards, publications, certifications, education offerings and subscriptions
- Enjoy reduced admission to AWS-sponsored events and conferences (FABTECH, etc.)
- Get discounted rates on insurance, travel, shipping, AWS logo merchandise and more

3 ENHANCE YOUR CAREER

- Increase your welding knowledge through AWS online seminars, including code clinics, destructive and non-destructive testing, metallurgy, economics, fabrication math and more.
- Get certified by the organization that sets the standards including Certified Welder, Welding Inspector, Welding Educator, Engineer, Sales Representative and more.
- Stay informed with complimentary subscriptions to Welding Journal (monthly), American Welder (quarterly) and Welding Marketplace (twice annually)

There’s no time like the present to start taking full advantage of your membership!
Spread the news and invite others to join!

aws.org/membership
December culminates the celebration of the American Welding Society's (AWS's) first 100 years and marks the beginning of a brand-new era. AWS's centennial birthday is more than just a celebration of the Society; it's a recognition of an ever-evolving industry. As the world around us rapidly changes, the Welding Journal asked industry leaders “What do you think the next 100 years will bring to the welding industry?”

By Cindy Weihl

“During the next 100 years, the industry will change in remarkable ways. Welding will become cleaner as manufacturers invent ways to eliminate the fumes and smoke we see today, and more efficient through the use of automation and the arrival of Industry 4.0. These innovations will solve the skills gap and help us attract more workers. Instead of welders and fabricators monitoring their equipment, the equipment will monitor itself, making automatic adjustments that optimize performance. Preventative maintenance will become predictive maintenance, with systems automatically placing orders for needed parts and drones delivering those orders. Also, I think instead of buying equipment outright as we do today, companies will instead choose to rent or subscribe to equipment. Similar to how we subscribe to services like Netflix, paying for it on a per-use basis rather than treating it as a capital expense.”

Jeff Deckrow, vice president, Hypertherm Americas

“The main challenge for welding and brazing in the next 100 years will be a revolution in structural materials. Traditional materials, such as carbon steel, stainless steel, aluminum, or copper alloys, nickel-based superalloys, and others have exhausted their maximum mechanical and physico-chemical properties and do not meet modern or future strength requirements, nor requirements for heat and oxidation resistance. New composite materials, including multilayer lightweight structures, nanocomposites, ductile ceramics, refractory, and high-entropy alloys will come into the industry during the next 50–100 years. The upcoming generation of structural materials will require new welding and brazing materials and processes for joining and reliable service.”

Alexander E. Shapiro, brazing products manager, Titanium Brazing Inc.
“Where the previous century focused on developing welding processes and filler metals, data-driven innovations and connected solutions will shape the future of the welding and cutting industry. Through an ongoing process of continuous improvement, our goal at ESAB is to provide companies with the technologies that help them put data to work in four areas: improving assets management, increasing productivity, streamlining traceability/documentation, and boosting first-pass quality.

Welding and cutting speeds are approaching the physical limits because you can add only so much heat to a part before degrading its metallurgy and mechanical properties. As a result, the richest productivity opportunities come from optimizing activities surrounding the arc, and making intelligent decisions requires accurate information. Welding- and cutting-oriented software, accessed through cloud-based solutions, will enable machines and humans to consistently achieve their peak performance.

In the future, virtually any piece of digital equipment that can become ‘smart,’ will be smart. Paired with 5G wireless technology and mobile applications, welders will rely on their smart phone as much as their welding helmet (which of course will have a real-time parameter display and weld discontinuity alerts).

What won’t change in the future is our need for highly skilled labor, especially in field applications. Workers will, however, use and train on smarter tools. In addition, our industry will create many new jobs not traditionally associated with welding, such as data analysts, software programmers, and automation technicians.”

Shyam Kambevanda, president, ESAB & SVP Colfax Corp.

“My welding and metal fabricating seem to me to enjoy an incredible accessibility when it comes to advancement. The great leaps that have come to my niche market of thermal spraying seem to have sprung from inventors and technicians, hands-on participants in the industry. Each time a new tool or technology has come to us from another field of research or exploration, someone has asked ‘what happens if we do this with it?’ and a new process is born. This makes our industry fertile ground for new ideas. The spectrum of energy sources is more broad today than ever before, from lasers to power supplies to plasmas, and the overwhelming trend in each has been toward lower cost and greater control. It would seem logical that all of this will point to the better use of high-performance materials. As the consistency and quality of advanced welding and joining techniques swiftly improves, designers and technicians will likely try and succeed in efforts to use long-lasting, high-durability materials exactly where they are most effective, while reducing cost and improving manufacturing efficiency everywhere else. More precise tools such as laser deposition and cold spraying will likely be key in this pursuit in the short term, as they reduce the need for unnecessary material and provide more dependable results.”

Daniel C. Hayden, president, Hayden Corp.

“At Lincoln Electric, staying connected to our customers and the end users of our products helps us anticipate their future needs. There is no question that the digital transformation sweeping manufacturing will have an impact on how goods are produced, operations are monitored, and goods are brought to market and used over the next century. The chief advantage of adopting digital tools and processes is efficiency and speed — shortened development cycles and reduced time to market. Beyond IoT and software solutions, metal additive manufacturing is, in some ways, spearheading this transformation. Advancements in production monitoring and remote preventative maintenance and diagnostics will continue to change the way operators, managers, and supply chains work in production environments.

On a related path, robotic and mechanized automation will continue to make strides that will increase production cycle time, quality, and worker safety. Other automated processes like cutting and motion control are trending toward increasing sophistication, so that one machine today replaces the work of multiple machines in the last century. Of course, artificial intelligence (AI) is poised to have an impact on fabrication moving forward. Collaborative robots are already improving the way we manage part programming, and automated systems may account for real-time, in-process programming.

Finally, new welding and cutting processes will continue to emerge. Our current work with friction spin welding and hot wire laser systems are pointing the way to new joining methods.”

Greg Doria, vice president, marketing, Lincoln Electric
“Like the first 100-plus years for Hobart and AWS, our industry will continue pioneering innovative ways to join metals in the next 100. Regardless of changes that take place with materials or processes, welding is likely to remain a core foundation of technological advancement in the world.”

David Knoll, vice president/general manager, Hobart Brothers LLC

“The welding industry is rapidly evolving with different applications and welding skill levels and is becoming more complex. Equipment manufacturers need to continue seeking ways to present targeted solutions to address these challenges. This will require a deep understanding of end users’ needs and value-added, differentiated products and support. Innovation has been the cornerstone of our contribution to the welding industry in the past, and we are committed to delivering customer-backed, innovation-based technologies to take us into the next 100 years and beyond.”

Anshu Mehratra, group president, Global Industrial Platform, ITW Welding

CINDY WEIHl (cweihl@aws.org) is senior editor of the Welding Journal.
Welder Performance Qualifier Endorsement

Scope of Endorsement

The Welder Performance Qualifier endorsement meets a portion of the requirements for senior welding inspector alternate qualification in AWS B5.1, Specification for the Qualification of Welding Inspectors, and alternate certification for the SCWI in QC1.

Who should take the endorsement?

Any CWI or SCWI who wishes to receive a credential that documents his or her knowledge, skills, and abilities to conduct welder performance qualification tests.

What are the requirements of taking the exam?

Candidates who hold an AWS CWI or SCWI wishing to take this examination to add as an endorsement to their AWS credentials shall be current in their AWS certification status.

What are the training requirements?

This endorsement has no mandatory training requirements. Candidates are encouraged to attend an AWS seminar or to perform self-study to become familiar with the Welder Performance Qualification subject matter.

What are the examination requirements?

Candidates seeking the Welder Performance Qualifier endorsement will need to pass an open book examination.

What are the test specifications?

Test specifications are a breakdown of exam content areas along with the proportion of the exam devoted to each content area. This endorsement exam consists of a minimum of 50 questions (Table 1).

What question types appear on the exam?

The exam will consist of multiple-choice items.

ISO Standards Endorsement

Who should take the endorsement?

Any candidate for initial CWI certification may choose this examination.
Table 1 — Test Specifications for the Welder Performance Qualifier Endorsement

<table>
<thead>
<tr>
<th>Domain</th>
<th>Subdomain</th>
<th>Percent of Questions on Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 01 Pretest Activities</td>
<td>0101 Qualifier Pretest General Responsibilities</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>0102 Equipment and Materials Required for Testing</td>
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<tr>
<td></td>
<td>0103 Facility Requirements</td>
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<tr>
<td>Domain 02 Conducting the Test</td>
<td>0201 General Requirements</td>
<td></td>
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<tr>
<td></td>
<td>0202 Welding Variables</td>
<td>40%</td>
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<tr>
<td></td>
<td>0203 Fitup and Welding of Test Coupon</td>
<td></td>
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<tr>
<td></td>
<td>0204 Testing Requirements</td>
<td></td>
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<td></td>
<td>0205 Retests</td>
<td></td>
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<tr>
<td>Domain 03 Posttest Activities</td>
<td>0301 Welder Performance Qualification Record (WPQR)</td>
<td>30%</td>
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<tr>
<td></td>
<td>0302 Documentation</td>
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<td>Total</td>
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<td>100%</td>
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Table 2 — Test Specifications for ISO Standards Endorsement

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<th>Domain</th>
<th>Subdomain</th>
<th>Percent of Questions on Exam</th>
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<tr>
<td>Domain 01 Qualification</td>
<td>0101 General Requirements</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>0102 WPS Qualification</td>
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<td></td>
<td>0103 Performance Qualification of Welders</td>
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<tr>
<td>Domain 02 Fabrication</td>
<td>0201 General Fabrication Requirements for Railway Applications</td>
<td></td>
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<tr>
<td></td>
<td>0202 Design of Welded Connections in Railway Applications</td>
<td>30%</td>
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<tr>
<td></td>
<td>0203 Welding Requirements for Railway Applications</td>
<td></td>
</tr>
<tr>
<td>Domain 03 Inspection</td>
<td>0301 General Requirements</td>
<td>30%</td>
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<tr>
<td></td>
<td>0302 Visual Testing</td>
<td></td>
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<tr>
<td></td>
<td>0303 NDT</td>
<td></td>
</tr>
<tr>
<td>Domain 04 Reports and Records</td>
<td>0401 General Reports and Records</td>
<td>5%</td>
</tr>
<tr>
<td>Domain 05 Materials and Design</td>
<td>0501 Base Materials and Consumables in Railway Applications</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>0502 Weld Joint Design in Railway Applications</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3 — Test Specifications for the Certified Resistance Welding Technician Exam

<table>
<thead>
<tr>
<th>Domains</th>
<th>% of Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Weld equipment setup, including machine/tooling design</td>
<td>15%</td>
</tr>
<tr>
<td>02 Welding processes and schedules</td>
<td>15%</td>
</tr>
<tr>
<td>03 Weld quality and testing, including destructive and nondestructive</td>
<td>12%</td>
</tr>
<tr>
<td>04 Definitions and terminology</td>
<td>10%</td>
</tr>
<tr>
<td>05 Welding symbols</td>
<td>3%</td>
</tr>
<tr>
<td>06 Materials</td>
<td>13%</td>
</tr>
<tr>
<td>07 Conversion and calculations</td>
<td>5%</td>
</tr>
<tr>
<td>08 Welding procedures</td>
<td>15%</td>
</tr>
<tr>
<td>09 Maintenance</td>
<td>12%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>
Certified Resistance Welding Technician (CRWT)

Scope of the Examination

AWS C1.5, Specification for the Qualification of Resistance Welding Technicians, and AWS QC20, Specification for AWS Certification of Resistance Welding Technicians, require a candidate to take a written examination to get certified in order to demonstrate his or her general knowledge of the resistance welding process and related technical areas.

Who should take the certification examination?

Anyone who works in the resistance welding field can apply for the certification.

What are the requirements of taking the exam?

Anyone who is a high school graduate or has equivalent educational background and also at least one year of work in the resistance welding field. Each individual seeking qualification shall have experience consisting of the design, application, or operation of welding lines or cells for the manufacture of welding products such as automobiles, appliances, wire products, sheet metal products, or other resistance welded products.

What are the training requirements?

This examination has no mandatory training requirements. Candidates are encouraged to attend an AWS seminar or to perform self-study to become familiar with the CRWT exam content in AWS C1.5, Specification for the Qualification of Resistance Welding Technicians, and AWS QC20, Specification for AWS Certification of Resistance Welding Technicians.

What are the examination requirements?

Candidates seeking the CRWT exam will need to pass a written examination.

What are the test specifications?

The test specifications are a breakdown of the exam content areas covered by the examination along with the proportion of the exam devoted to each content area (Table 3). This examination consists of a minimum of 100 questions.

What question types appear on the exam?

The exam will consist of multiple-choice items.

The All-New Light a Spark Grant Could Get Your Local High School A Starter Welding Package!

Ignite your school’s interest in welding and apply now!

The AWS Foundation and Miller® are bringing the welding experience back to the classroom!

The all-new Light a Spark Grant® is a turnkey package designed to introduce welding into an existing secondary Ag-Ed, Career and Technical Education, or Practical Skills course.

Up to 10 lucky schools that do not currently offer welding instruction can get a Miller® Welding Starter Pack filled with equipment and supplies valued at more than $12,000!

Encourage your school to apply for the Light a Spark Grant Today!

Learn more at aws.org/sparkgrant

*Secondary or post-secondary schools that have an existing welding program or course are not eligible for the Light a Spark Grant but may be eligible for the Welder Workforce Grant. See aws.org/wwg for details.
Our Corporate Members Get MORE

Whether your organization has joined American Welding Society as a Supporting, Sustaining or Affiliate member, as a Distributor or Educational Institution, we are proud to support the companies and organizations that support us. Here are just some of the ways our AWS Corporate members experience MORE:

MORE ACCESS

- Membership for up to twenty (20) people (depending on membership level)
- Complimentary VIP passes to FABTECH for staff incentives or customer relations
- Exclusive usage of the AWS Corporate Member logo on your business and promotional materials
- Annual subscription for each member to the award-winning *Welding Journal* and *American Welder* (a special section of the *Welding Journal*).
- Company Listing on *AWS.org*.

MORE PROFESSIONAL GROWTH

- Customized seminars and workshops for your organization
- Member-only networking opportunities at AWS-sponsored events
- Online AWS Standards eLibrary Access for your employees (depending on membership level)

MORE DISCOUNTS

- 25% off over 300 technical standards and publications offered at the AWS Bookstore
- Additional 5% discount off the already-reduced member registration price of any AWS conference
- Savings on certification programs and seminars offered through AWS
- Get discounted rates on insurance, travel, shipping, AWS logo merchandise and more

To review, renew or increase your membership benefits, contact American Welding Society

T: 800-443-9353, ext. 480. | info@aws.org | aws.org/membership