

WELDING JOURNAL



JANUARY 2026

**Welding Gas Safety
and Selection**

**The Science behind
Flame-Resistant Apparel**

**Metal Cored Wire
in Submerged
Arc Welding**

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AWS Mission Statement

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A Welding Success Story: How AWS Shaped My Career

As I stood before the audience at AWS's Opening Ceremony at FABTECH, I felt a deep sense of gratitude and pride. Being named the incoming president of AWS is an honor that reflects not only my personal journey but also the collective support and opportunities this organization has provided me over the years. I want to share that journey, not as a personal biography but as a testament to the transformative power of AWS.

From High School Welder to Metallurgical Engineer. My introduction to welding occurred during high school, where I quickly developed a passion for the craft through participation in welding competitions. I competed at regional, state, and national levels, eventually earning the chance to represent the United States at WorldSkills. It was during the Skills pretrials that I discovered the science behind welding and metallurgy, which inspired my decision to become a metallurgical engineer.

I earned both my bachelor's and graduate degrees from the University of Tennessee and began my career at Alstom Power. Later, I joined General Electric, and today, I serve as a senior program manager at the Tennessee Valley Authority, overseeing non-nuclear welding and inspection programs.

AWS at Every Step. While my career path may sound linear, the real story lies in the support I received from AWS at every critical juncture.

At 17, after winning the state welding championship, I qualified for the national competition. The cost of travel and lodging was a barrier until my instructor contacted our local AWS Section. It agreed to sponsor me but with one condition: I become an AWS Student Member. That \$15 membership opened the door to a \$1200 opportunity. After the competition, I qualified for the WorldSkills pretrials. The materials and machining costs exceeded \$3000, and our school lacked the necessary equipment. Once again, AWS members stepped in.

Discovering Metallurgy. During the pretrials, I faced new challenges and began asking deeper questions about the science behind welding. My instructor encouraged me to speak with a metallurgy professor at the University of Tennessee. After some nudging, he personally drove me to meet that professor. That visit changed everything. The professor welcomed us, answered my questions, and arranged a tour of the metallurgical lab. Seeing microstructures and hardness maps firsthand solidified my decision to pursue a career in engineering. My career trajectory shifted from tradesman to engineer in that moment.

Education and Career Support. Using the AWS SENSE certifications I earned in school, I worked as a welder to fund my education. AWS scholarships also helped ease the financial burden. When I graduated in 2009, the job market was uncertain. However, the same professor who had inspired me years earlier offered me a graduate research opportunity under the guidance of AWS Fellow Dr. Carl Lundin.

Leadership and Giving Back. Though I remained active in AWS, I hadn't held a leadership role until Past President Tom Mustaleski entrusted me with chairing the Northeast Tennessee Section. That opportunity led to my election to the AWS Board of Directors in 2013 and eventually to my role as vice president in 2022.

Now, as I prepare to serve as AWS president, I reflect on the journey that brought me here. Individual members and local Sections made the biggest impact on my life, and I intend to use this platform to promote membership and strengthen our welding community.

AWS continues to evolve with a strategic focus on enhancing customer success, improving core programs, upgrading operational systems, and expanding our global reach. These initiatives are designed to ensure AWS remains a leader in welding science and technology.

Since its founding in 1919, AWS has remained committed to advancing the science and technology of welding and joining processes. In 2026, we will continue that mission with renewed energy and innovation.

As I travel to Sections, and communities, I aim to highlight the value of AWS membership, encourage engagement, and spotlight the work of the AWS Foundation. Together — with our staff and board — we will strengthen our core, innovate boldly, and ensure AWS continues to serve and inspire generations to come. [WJ](#)



Dr. D. Joshua Burgess
AWS president

“As I prepare to serve as AWS president, I reflect on the journey that brought me here. Individual members and local Sections made the biggest impact on my life, and I intend to use this platform to promote membership and strengthen our welding community.”



BY MACKENZIE SCHURR

FLAME-RESISTANT APPAREL:

The Science behind the Fabric and Five Myths Busted

Learn about advances in apparel safety and how to select welding attire

Most people roll out of bed and put on the first shirt they see without a second thought. However, for welders, that shirt can be the difference between walking away from an incident or sustaining major burns.

As good examples, welders have their welding helmets, electrode holders, and flame-resistant (FR) welding apparel to protect themselves. But although these items are highly engineered for protection, FR clothing isn't invincible.

It's essential to understand the differences between FR and non-FR options.

The Science Involved in Your FR Apparel

FR means the fabrics are designed to self-extinguish when exposed to flames or high heat (Ref. 1). Unlike standard cotton or polyester blends, FR apparel doesn't continue burn-

ing and won't melt onto your skin. While FR isn't specifically designed for welding, it is a necessary precaution when welding in environments such as live plants or facilities with combustible materials.

There are various methods for creating FR apparel. One option treats non-FR fabrics with a chemical process that adds a FR coating. This option can be more cost-effective and can be applied to any number of fabrics; however, the coating may wash or wear out over

time. Another option uses fabrics and fibers with flame-resistant properties, which offer permanent FR protection for the life of the garment but can cost more.

In recent years, innovations and advancements in FR apparel safety have been impressive. Material manufacturers are creating leading-edge coatings (Ref. 2) in which resin fills the spaces between the threads, so sparks have nowhere to go but off the garment instead of through the holes and onto your skin, causing burns.

Busting the Top Five FR Apparel Myths

Myth #1: Wearing FR Apparel Means Sparks Won't Get Through

FR apparel is critical in a flash fire; however, if you're gas metal arc welding, gas tungsten arc welding, welding as a hobby, or just learning the trade, any sparks that land on you and sit will get through. People sometimes complain that their FR apparel didn't last after a shift spent grinding sparks into their stomachs or letting sparks accumulate in folds of the fabric. FR will keep you safer in a flash fire but will not provide any additional benefits beyond a non-FR option with welding spark protection.

Myth #2: Non-FR Offers Limited Protection

If you are not required to wear FR clothing based on the environment you're working in, a non-FR apparel option could be suitable. FR doesn't stop sparks from getting through your apparel; it will only help you if you're ever caught in a flash fire. Welders can wear non-FR clothing,

such as 100% cotton, which tends to be more cost-effective and offers more style options. The key is knowing what the job entails and making sure you wear the right gear.

Myth #3: You Need FR on Every Site

Not every job requires FR apparel, but certain industries make it a non-negotiable requirement. The Occupational Safety and Health Administration and National Fire Protection Association standards mandate that wherever workers may encounter fire or electric arc flash hazards (such as oil and gas facilities and pipelines, foundries, and other metalworking areas), it is mandatory.

I recall welding on a live pipeline up north, with three gentlemen holding fire extinguishers all pointed at me the entire time. I was wearing my FR apparel, along with a number of other personal protective equipment precautions, because the job required it. FR isn't needed everywhere, but when the risk is real, it's essential.

Myth #4: FR Apparel Is Clunky and Uncomfortable

Thanks to advances in FR apparel and fabric innovation, FR can be:

- Lightweight and breathable
- Mobile and flexible
- Moisture wicking
- Washable
- Stylish with fun colors

When purchasing FR apparel, remember that comfort and protection can go hand in hand, and be sure to research your options before making a purchase.

Myth #5: The Only FR Apparel Is a Shirt and Pants

Over the years, numerous entrants have emerged in the FR apparel field, most notably welding jackets, welding hoodies, work pants, gloves, and other related products. The future of FR apparel is focused on blending protection with comfort, style, and durability. There's also a push to explore eco-conscious materials, which is particularly relevant in the welding space, given that the nature of the work can quickly deteriorate the garment.

Parting Words

Understanding the science behind FR apparel is critical to ensuring you select the right apparel for your welding job. Education is empowerment, and comprehending what FR is and isn't helps keep you informed so that you can stay safe, comfortable, and on budget for any job. [WJ](#)

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Getting a Grip on **Handheld Laser Safety**

**Six steps to protect operators and
personnel from laser hazards**

A handheld laser welding system can be a powerful tool when speed, precision, and productivity are critical to your project or operation. The welding industry is experiencing a surge in interest in this new technology, but many remain unfamiliar with its potential hazards.

For example, the diffusely reflected beams from a Class 4 laser can permanently damage eyes, burn skin, or ignite combustibles. The Class 4 hazard classification applies to lasers operating at 0.5 W or higher. Many industrial handheld lasers are available in the 1000- to 2000-W power range, exceeding the class threshold by several orders of magnitude.

“Having that level of power in the palm of your hand requires knowledge, planning, and proper safety protocols to mitigate risk and prevent injuries,” said Chris Agosti, an engineer and laser safety officer (LSO) for Lincoln Electric’s Laser Materials Processing Group. “Industry leaders need to inform the public about the safety requirements and best practices of handheld laser tools and their use.”

Six Safety Steps

Agosti, a member of several subcommittees and industry panels on laser safety, outlined a series of preliminary action steps promoted by the American National Standards Institute (ANSI), International Electrotechnical Commission (IEC), Laser Institute of America, and AWS intended to help users maximize safety for handheld laser welding tools.

1

Understand the risks of Class 4 laser exposure.

The three previously stated exposure risks — eye hazards, skin burns, and fire hazards — are associated not only with direct exposure but also with indirect, scattered reflections. Be aware of the nominal ocular hazard distance, which is the distance at which the laser energy, direct or reflected, is a hazard to the eyes.

2

Appoint an LSO and ensure they have proper training.

Any operation using a Class 4 handheld laser system is required to designate an LSO. The LSO can either be a properly trained member of the existing staff or someone contracted from outside. Regardless of their affiliation, the LSO should undergo laser safety training requirements as

defined by the ANSI Z136 series of standards.

“The LSO must have ownership and authority over the safety measures that are being implemented,” Agosti said.

3

Train and educate all personnel affected (including those working nearby or who may require entry into the laser workspace).

In addition to training the LSO, anyone potentially exposed to handheld laser radiation must also receive proper training in accordance with ANSI requirements. Agosti noted that, as with any workspace, safety in the laser environment should be a mindset, not just a procedural box to check off.

“We have a lot of steps in place to keep individuals safe,” he said. “But training is one of the primary differentiators. Teaching users about the hazards and what they need to do to avoid them increases their awareness, and they are empowered to keep themselves safe. It’s no longer a matter of following rules at that point. It’s an owned awareness.”

4

Document a written laser safety program.

Maintain a written safety plan and make sure the operator(s) and all other personnel are familiar with it. Typically, the LSO is the individual responsible for

developing the written plan and ensuring that all personnel adhere to it.

A written safety plan is essential for every user, regardless of the size or scope of your manufacturing operations. Class 4 handheld lasers are industrial equipment and should not be used recreationally or by home hobbyists. Ultimately, safety is paramount. If a user cannot ensure that the appropriate safety measures are in place, they should refrain from using a handheld laser.

5

Designate a laser-controlled area (LCA) or otherwise enclose the handheld laser workspace in a booth/box/surround.

Identify the specific physical parameters of your LCA and ensure they are clearly marked and visible to the operator(s) and other personnel.

The LCA should be an enclosure with noncombustible laser-blocking panels, an access door with an interlock switch, and a “Laser On” visible or audible warning indicator. Any barriers or windows used should be made of laser-rated material that can withstand direct and reflected beams. Aluminum and steel are effective, but ensure they are correctly rated for your specific laser application. Mirrorlike and reflective surfaces are undesirable in the LCA and must be excluded from the beam path.



A safety interlock door latch.

“Understand the space in which you’re going to be operating the laser and where you’re directing the beam,” Agosti said. “Laser energy transmits through space, so the hazards persist over long distances — sometimes thousands of meters.” Unprotected individuals must not have access to direct line of sight with the laser.

6 Wear laser-rated personal protective equipment (PPE).

Appropriate laser safety eyewear is critical, but PPE also includes a helmet, heat-resistant gloves, and flame-retardant clothing. The most serious hazard associated with Class 4 lasers is the risk of eye injury. Operators and exposed personnel must always use safety eyewear that’s specifically rated for the application, wavelength, and minimum optical density. In addition to PPE, a fume control system should be in place to manage laser-generated airborne contaminants (LGACs). Over time, unprotected exposure to LGACs may result in health issues.

“Fumes generated from the laser are finer and may be less perceptible than arc welding fumes,” Agosti explained. “A reliable fume extraction system or an air purifying respirator (with filter media sized appropriately for the size of the fume particulate) should be used at all times during laser operation.”

Best Practices

Adhering to widely accepted best practices can also help enhance safety in your operation:

■ **Torch angle.** The proper torch angle should always be between 30 and 70 deg in relation to the work surface. Avoid positioning the torch nozzle at either a right angle or an acute angle.

An operator wears laser-rated safety glasses and a laser-rated welding helmet.

■ **Head and body position.** At all times, the operator should be aware of the position of their head and other body parts in relation to the laser’s direct and reflected beam path.

■ **Proper hot work practices.** Follow established laser welding safety protocols for hot work, including fire prevention measures, removing flammable materials from the work area, and ensuring that appropriate fire extinguishing equipment is readily available.

In addition to the requirements listed above, some handheld laser systems offer features and options that are not mandatory but could help add a layer of safety to your operation:

- Activation code required for initial start-up
- Shielding gas detection alarm
- Contact-based safety feedback circuit

Agosti recommends partnering with a reputable manufacturer or distributor rather than opting for an obscure brand that no one has heard of. When in doubt, consider a turnkey solution.

“If you’re not comfortable with all of the safety and compliance requirements, there are handheld laser manufacturers that also make laser booths and integrated fume extraction products,” he said. “Many also provide proper signage, door interlocks, and lighting to make compliance easy.”



For a comprehensive overview of all safety guidelines related to handheld laser tools, refer to the following:

- ANSI Z136.1, *Safe Use of Lasers*
- ANSI Z136.9, *Safe Use of Lasers in Manufacturing Environments*
- IEC 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements*
- ISO 11553-1, *Safety of machinery — Laser processing machines — Part 1: Laser safety requirements*
- AWS Safety and Health Fact Sheet No. 46, *Handheld Laser Welding Safety* (aws.org/standards-and-publications/free-resources)

At all times, the operator should be aware of the position of their head and other body parts in relation to the laser’s direct and reflected beam path.



Safety without Fear

Maintaining safety with handheld laser operations can seem daunting. The requirements are rigorous because the potential hazards are significant, but that shouldn't scare users from reaping the benefits of the technology. Get informed, get an LSO, and get trained.

"We want to make sure that users have proper respect for the tool," Agosti said. "If they don't, they can hurt themselves, or they can hurt others, and we don't want that. It's not good for the user, the laser manufacturer, or the laser industry overall. As long as we use [lasers] safely, effectively, and productively, we can ultimately transform the future of the industry." [WJ](#)

This article was written by the **LINCOLN ELECTRIC LASER TEAM**, Lincoln Electric, Cleveland, Ohio.

An operator uses a handheld laser welding system.



Welder Profile

Welding beneath the Surface

From welding in high school metal shops to tackling complex underwater repairs, Ryan Gilbert has built a career defined by skill, adaptability, and grit. Inspired by his father and guided by hands-on training, Gilbert now works as a commercial diver. In this Q&A, the AWS District 9, Morgan City Section member shares how he got started, what it takes to succeed in subsea environments, and why every challenge is an opportunity to learn.

What inspired you to become a welder and how did you get started in the industry?

My father was my greatest inspiration to pursue a career in the trades. As a multicrafted journeyman, he taught me the skills, discipline, and work ethic essential for a successful career as a tradesman. In high school, I enrolled in the metals program at Harris County High School in Hamilton, Ga., under the instruction of Mark Howington. There, I discovered my passion for welding. That program gave me a strong foundation, allowing me to graduate with real-world certifications and college-level training that helped me enter the industry with confidence.

Tell us about your current role and what you do.

As a commercial diver, I work on a wide range of subsea projects that require adapting to new trades and environments on the fly. Our job demands the ability to perform mechanical, structural, and technical work in constantly changing conditions. My experience includes welding, burning, nondestructive testing inspections, ship husbandry, and subsea survey work. I've piloted atmospheric diving suits, supported platform and pipeline inspections, and assisted with major salvage operations, including the Francis Scott Key Bridge collapse [a steel arch bridge in Baltimore, Md., that collapsed in 2024 after being struck by a container ship]. Diving requires not only physical endurance but also the ability to learn quickly, solve problems in zero-visibility environments, and safely apply multiple trades while working completely underwater.

What certifications/training do you have?

I attended commercial diving school and earned both national and international diving certifications. I'm also a Diver Medic and hold a National Registry Emergency Medical Technician (EMT) certification along with international Diver Medic Technician (DMT) credentials. In addition, I've received on-the-job certifications, including ASNT Level II NDT (visual testing, magnetic particle testing, penetrant test-



Fig. 1 — Welder Ryan Gilbert is seen after completing preparations for underwater welding repairs on a flood gate in Theriot, La.

ing, and ultrasonic thickness gauging) and NAVSEA welding qualifications.

What's the most challenging project you've worked on, and how did you overcome the obstacles?

One of the most challenging projects I've worked on was a pipeline repair where we had to install a clamp over a defect in the line. The pipeline was buried 15 ft into the seabed, and we had to uncover it by hand jetting in zero visibility. As a new diver, taking on a job like that safely was extremely demanding. I overcame the challenges by slowing down, working methodically, and prioritizing safety above everything else. We finished with the main opening of the hole roughly 20 ft. wide by 60 ft. deep, so we could set a caisson box and complete the repair in a dry environment.

What's your favorite thing about being a welder?

My favorite aspect of my job is always having something different and challenging to work on. It's a great feeling to look back on projects I've been on and be proud of the work I've put into them.



Fig. 2 – Gilbert installing a tendon tension monitoring system (TTMS) cables on the Allegheny Tension Leg Platform in Green Canyon Block 254 (GC-254) in the Gulf of Mexico.



Figs. 3 and 4 – Gilbert suited up during atmospheric diving system hardsuit training.



Fig. 5 – Gilbert (far left in the blue jacket), is pictured with the Phoenix divers and the Maryland State Police Diving Team. The photo was taken during the salvage of the Francis Scott Key Bridge collapse.