INSPECTION TRENDS

AUGUST 2025

THE MAGAZINE FOR MATERIALS INSPECTION AND TESTING PERSONNEL

Steel Construction Quality Planning

Why Pipe Welding Quality Matters

Weld Coating Inspection

AWS®

IN THIS ISSUE: UNETHICAL DECISIONS ■ THE ANSWER IS: IMPROVE STRUCTURAL STEEL QUALITY

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New CWI Syndrome

SHANEN ARANMÓR

You passed the difficult AWS Certified Welding Inspector (CWI) test, and you are now a bona fide CWI. You celebrate and commiserate with others who took the test with you. At first, you love the instant notoriety. You might even experience a touch of the so-called New CWI Syndrome — a mild superiority complex.

Eventually, though, you realize that everyone expects you to know everything about every code, welder qualification, certification, etc. You try to hide the fact that you don't know very much at all. Unless you have a mentor, you're figuring it out as you go. You probably only know one code (AWS D1.1, *Structural Welding Code — Steel* or D1.2, *Structural Welding Code — Aluminum*, etc.) and not much more.

Things get tricky when you consider that CWIs are not required to know how to weld and welders don't have to know anything about inspection. That's where a rift often arises.

However, if we can all agree that welding has discontinuities and defects, perhaps we can grow together. According to the Hobart Institute student workbook EW512-3, *Welding Procedures and Qualifications*, welding imperfections fall into three categories: external dimensions, structural discontinuities, and weld/base metal properties. Once we understand the terminology and see real examples, we might finally get on the same page.

Welding flaws that affect external dimensions relate to the shape, size, and contour of a weld. These include excessive reinforcement, incorrect size, incorrect profile (overlap, undercut, spatter, convexity, etc.), and incorrect final weld dimensions. Structural discontinuities refer to internal consistencies such as cracks, porosity, slag inclusions, incomplete fusion, and inadequate joint penetration. Issues with weld and base metal properties typically involve the match (or mismatch) between the two. These include (but are not limited to) tensile strength, yield strength, ductility, and impact strength.

As a welder and inspector, I suggest that CWIs become familiar with what procedures actually call for. Is the position or order of operations even possible? If not, welders won't do it. In that case, the only solution is to rewrite the procedure. Additionally, inspectors should speak in welder terms if it doesn't sound forced. Hint: If you don't know how to weld, don't pretend you do. Welders can be a brutal bunch if they think you're an impostor. Own what you know. You are a CWI. You passed a very difficult test, and you understand discontinuities and defects. If you don't try to tell a welder how to fix their mistakes, you might make it out alive.

As far as welders/welder operators are concerned, I suggest that we ask for the procedure and mock-up (or example part) in advance. If someone else could weld it, we could as well. As an example, over the last two years, I have worked closely with a company that welds and brazes HVAC systems for aerospace. Customers provide a mock-up of welded and/or brazed parts, and employees follow procedures and attempt to reproduce those results. If difficulties arise, they reach out to the customer for clarification. They ask questions about expectations. I'm not saying it's all sunshine and roses, but it is not an us-versus-them situation either.

We were all new once. As you gain experience, you improve your CWI skills and build bridges with welders and supervisors. Hopefully, you will also become humbler. It's okay to not know everything. In fact, it would be boring if we did.

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AWS Delivers Inaugural Company-Certified Thermoplastic Welding Inspector Training in Malaysia

AWS, Miami, Fla., completed its first Company-Certified Thermoplastic Welding Inspector Training and Examination workshop in Sungai Petani, Kedah, Malaysia. The event, hosted at the AWS Accredited Testing Facility Kedah Industrial Skills and Management Development Centre (KISMEC), was organized in collaboration with AWS international agents United Technologies (Malaysia) and KHST (Taiwan).

The three-day workshop, held from May 26 to 28, was led by Dr. Chon-Liang Tsai, a retired professor of welding engineering at The Ohio State University and an AWS Fellow. Tsai is also chair of the new AWS Certified Plastic Welding Inspector (CPWI) program, which is currently under development.

Participants attend classroom instruction during AWS's inaugural Thermoplastic Welding Inspector Training and Examination workshop in Sungai Petani, Malaysia.

The impetus for this workshop arose from the increasing demand for thermoplastic welding expertise, particularly driven by Malaysia's rapidly growing semiconductor industry and other high-technology sectors, including aerospace and medical device manufacturing.

The workshop was designed to deliver a comprehensive understanding of thermoplastic welding inspection, covering fundamental material behaviors, weldability, and chemical characteristics essential to thermoplastic welding applications. Tsai provided a detailed overview of AWS B2.4, *Specification for Welding Procedure and Performance Qualification for Thermoplastics*, which outlines qualification requirements for thermoplastic welding; AWS G1.6, *Specification for the Training, Qualification, and Company Certification of Thermoplastic Welding Inspector Specialists and Thermoplastic Welding Inspector Assistants*; and G1.10, *Guide for the Evaluation of Hot Gas, Hot Gas Extrusion, and Heated Tool Butt Thermoplastic Welds*.

The program also included valuable comparisons to internationally recognized standards, including those from the German Welding Society (DVS), International Organization for Standardization (ISO), and American Society for Testing and Materials (ASTM International), to equip participants with a broad perspective on global best practices and inspection criteria.

One of the workshop's highlights was the practical hands-on sessions. Participants engaged in real-world inspection scenarios, working with specimens of various types of thermoplastic welds to apply their theoretical knowledge. These exercises ensured participants could confidently perform visual and mechanical inspections in accordance with industry standards.

In addition to the technical aspects of thermoplastic welding inspection, the workshop emphasized the importance of developing a robust company-based written practice for qualification of thermoplastic welding inspection assistants and specialists. This aspect is vital for companies seeking to establish a consistent and reliable inspection process for their operations, ensuring compliance with AWS standards and elevating the overall quality of their thermoplastic welding programs.

This event is an essential step in laying the groundwork for the upcoming AWS CPWI certification program.

The successful delivery of this workshop marks a significant achievement for AWS and its partners in Malaysia and Taiwan. It demonstrates AWS's strong commitment to supporting the growth of advanced manufacturing industries in the region by providing critical training opportunities. — *Steven Snyder, AWS regional director, welding technology services*

Participants gather outside the training facility for AWS's first thermoplastic welding inspector workshop.

AWS Holds Welding and Coating Cross-Disciplinary Training Webinar

AWS is hosting a webinar series to help inspectors expand their skills in both welding and coating inspection.

AWS, Miami, Fla., is offering a webinar series designed to bridge the gap between welding and coating inspection expertise, addressing industry demand for inspectors with cross-disciplinary skills. Traditional career paths see professionals specialize in either welding or coating inspection, but real-world projects often require integrated knowledge. Inspection processes in welding and protective coatings are critical to ensuring the integrity and longevity of structures across industries.

Instructor Jorge Reyna, who holds multiple inspection certifications and has global experience in welding and coating inspection, has helped professionals succeed across various industries, including construction, defense, and manufacturing.

The training will help attendees navigate the shift from welding to coating inspection, highlighting key differences, complementary practices, and strategies to improve collaboration. Participants will learn to identify critical issues in both fields, from weld defects to coating failures, and explore the latest trends in integrated inspection workflows. They will also be able to differentiate inspection roles, master transition points, identify common defects, apply standards, and develop effective collaboration strategies between welding and coating teams.

The webinar is approximately eight hours long, comprising two-hour sessions spread across four days. The sessions will take place November 11, 13, 18, and 20. For details and registration, visit *aws.org* and search "Welding and Coating Inspection Webinar."

Wabtec Adds Evident's Inspection Technologies Division

Wabtec Corp., Pittsburgh, Pa., a global provider of equipment, systems, digital solutions, and services for the freight and transit rail industries, has acquired the Inspection Technologies division of Evident, formerly part of the Scientific Solutions division of Olympus Corp., for $1.78 billion. The acquired business brings established expertise in nondestructive examination, remote visual inspection, and analytical instruments used to evaluate mission-critical assets.

"Inspection Technologies' product portfolio strongly complements our existing digital technologies while adding advanced automated inspection capabilities in a space where data acquisition, analytics, and automation are critical," said Nalin Jain, president of Wabtec's Digital Intelligence Group. "It will accelerate the development of scalable technologies by integrating advanced analytics, sensors, and AI technology to deliver enhanced predictive maintenance capabilities to our customers. Evident Inspection Technology employees have done a fantastic job in delivering these innovative technologies, and I am looking forward to welcoming them to the Wabtec family."

AWS Hosts CWI Nine-Year Seminar

AWS held a Certified Welding Inspector (CWI) nine-year recertification seminar May 4–9 at its World Headquarters in Miami, Fla. Instructor John Yochum led the seminar. Yochum is a CWI with more than 15 years of experience in the construction industry. He has more than 25 years of teaching experience as a welding and engineering instructor in South

The CWI nine-year seminar attendees earned their recertification and visited the Emm-Trace facility.

Florida public education and technical schools and state college programs.

Participants toured the Emm-Trace facility and learned about the company's architectural and structural fabrication projects.

The attendees of the seminar were Cody D. Beasley, Garey Bish, Joel Boley, Daniel Darcey, Cesar Augusto Garcia Nunez, James Guderyon, Michael L. Hastings, Logan Millay, James Moore, Kyle Mullin, Zach Osgood, Vernon Phillips, Riley Swenson, Eli Wales, Jordan Wineland, James Scott, Richard Nigra Jr., Cesar Cornejo, Kenneth Cox, and Dexter Norman.

ASNT Partners with the Inspection Technology and Quality Assurance National Institute

The American Society for Nondestructive Testing (ASNT), Columbus, Ohio, is collaborating with the Inspection Technology and Quality Assurance National Institute (ITQAN), a Saudi Arabian institute that provides training programs to address market needs and support local workforce development.

This partnership promotes nondestructive examination (NDE) through ITQAN's education and training programs and ASNT's training and certification offerings. As part of this alliance, ASNT and ASNT Certification Services LLC will provide ITQAN with the ability to offer ASNT-approved training courses, certification preparatory courses, and ASNT certifications.

"Our goal is to collaborate with a local, well-established organization to deliver ASNT products and services to the region," said Paul Lang, ASNT chief global strategy officer. "This will enhance local workforce development, assist in upskilling personnel, and elevate the quality and education of NDT personnel in Saudi Arabia."

This collaboration will promote and deliver ASNT courses to ITQAN's student body and the public. The courses will cover general and advanced NDE knowledge and specific training to support the ASNT 9712 and ASNT NDE certification programs.

KTA-Tator Inc. Expands NDE Services at New Pittsburgh Facility

KTA-Tator Inc. (KTA), a provider of testing and inspection services, has opened a new testing facility in Pittsburgh, Pa. This location expands the company's ability to deliver nondestructive examination (NDE), mechanical testing, and destructive testing services.

The facility is equipped to support various specialized services, including mechanical testing, weld procedure and performance qualification, rail weld qualifications, Certified Welding Inspector consulting, and more.

"Our new facility represents a significant investment in the future of KTA's nondestructive and destructive testing and quality assurance services," said Jim Kretzler, NDE department manager of KTA. "By expanding our capabilities with this dedicated facility, we can better serve our clients with more services, faster turnaround times, and the highest level of expertise."

TIGHITCO Overhaul Support Services Now Offers Mobile NDE Capabilities

TIGHITCO, Charleston, S.C., an industrial and aerospace manufacturer, has launched its worldwide mobile nondestructive examination services through its MRO division, Overhaul Support Services (OSS), in East Granby, Conn. This new capability enhances the company's on-site inspections for critical aircraft components and field repairs.

"I'm excited to announce our expansion into mobile NDT," said Brett Gillespie, general manager of OSS. "This is a significant achievement that positions our team to support customers with essential on-aircraft inspections. Our FAA certifications align with industry standards for nondestructive testing in the aviation industry. Capabilities include eddy current inspection, ultrasonic inspection, and fluorescent penetrant inspection. We look forward to growing our mobile NDT team and providing essential NDT services to our valued customers."

Dürr NDT Panels Support Weld Inspection for Next-Generation Space Stations

As NASA prepares to retire the International Space Station (ISS), private companies are stepping in to fill the gap left by the ISS in low Earth orbit. One contender, California-based Vast Space, has announced Haven-2, a modular space station proposed for NASA's Commercial Low Earth Orbit Destinations program. The first module is expected to launch in 2028.

Ahead of that mission, Vast is already building Haven-1, a single-module commercial station scheduled to launch in 2026. To support critical weld inspections on components for both projects, the company has adopted Dürr NDT digital radiography systems.

Vast will use Dürr NDT digital radiography panels and software to inspect welds on structural components of the Haven space station. (Photo courtesy of Vast.)

Willick Engineering worked with John Stewart, founder of AATA and radiation safety officer, responsible level 3 at Vast, to implement Dürr NDT's equipment. The inspection team is using the D-DR 1025B NDT and D-DR 1043B NDT bendable digital panels, along with the high-resolution 19-micron DR 7 NDT detector for detailed imaging. All systems are operated through Dürr's D-Tect X software platform.

"The Dürr system and software are easy to use," Stewart said. "Currently, we utilize multiple bendable panels and the 19-micron DR 7 high-resolution detector. The systems are easily interchangeable and user-friendly."

These digital radiography tools are being used to inspect structural welds on the Haven modules' exteriors, ensuring weld integrity in a mission-critical environment.

BY KRISTIN CAMPBELL

An Eye for Inspection Leads to Career Success

CWI Tyler Smith has extensive industrial experience, from family construction work to inspecting floor-to-ceiling infrastructure.

Tyler Smith's interest in welding goes back to when he began working for the family's construction business.

"Quality of work was key," Smith remembered. "The only form of advertisement was word of mouth. This mentality, you could say, was where my eye for inspection started."

That mindset has been part of the family business. For perspective, Smith Brothers Inc., located in Hanover, Pa., started in 1983 and remains a full-service general contractor. The years have proved to the company that quality is essential, so there's no cutting corners. While there are more ways to advertise, word-of-mouth recommendations matter, so the company always puts its best foot forward. Inspections and taking the time to ensure tests are performed right the first time are important. To this day, Tyler Smith follows these practices.

Learning, Working, and Growing Professionally. As Smith's interest in inspection grew, he graduated with a bachelor's degree in welding and fabrication engineering technology from Pennsylvania College of Technology. Afterward, he accepted a job at John Deere in Davenport, Iowa, where he was interning.

Smith said his interest in inspection grew when he started applying his welding skills and working closely with the quality engineers at John Deere. After leaving the agricultural machinery provider and moving back to the East Coast, he took a job as a welder at the fabrication shop KLK Welding in Hanover, Pa.

"This allowed me to keep up my skills as a welder and improve my craft," he said. "I took a leap forward by becoming the quality manager for a laser and fabricator firm in Hanover, Pa., called PCI, shortly after." Being there allowed him to understand more about quality and compliance in manufacturing products, not only for welding. It also gave him insight into the requirements flow and allowed him to explore a different side of the business.

Wanting to return to his welding roots, Smith later took a job with Eaton Corp., where he became the lead welding engineer at one of the company's aerospace plants in Maryland. After working within the aerospace industry for almost six years, he decided to take a position that diversified his welding and inspection skills by joining Earlbeck Gases & Technologies in Rosedale, Md. He oversaw the technical division of the business, including testing, training, consulting, inspecting welders' work, and welding jobs.

"Ensuring you have all the tools needed at your fingertips is key to not only the success of a job but also builds confidence with the owner and/or supervisor of the job you're inspecting."

After a few years there, he accepted a job with his current employer, Tate Inc., Jessup, Md., as its divisional technical manager. The company produces and manufactures products used to house data centers as well as access flooring and ceiling grids. Multiple welding processes are used, including gas metal arc, resistance spot, and projection welding, to make different products. The company employs hundreds of employees and has plants in several states and worldwide. He works closely with multiple departments within each plant and communicates with vendors.

"It is very important to ensure that the information flow is received to the location that is required to see it," Smith said. "Not only do Certified Welding Inspectors [CWIs] inspect products visually, but they also make sure that the supporting information to the welders is being given correctly and is controlled." In particular, he inspects floor-to-ceiling infrastructure and looks for discontinuities and defects within the welding process, as well as opportunities to enforce the skill and knowledge of welding in the workforce that produces the products.

CWI Background. Because the aerospace company he worked for required welding engineers to be certified, Smith became a CWI in the winter of 2017. Before taking the tests, he flew to Troy, Ohio, for a two-week CWI training at Hobart Institute of Welding Technology.

Smith used his CWI status to train, consult, and inspect welded products to AWS D17.1, *Specification for Fusion Welding for Aerospace Applications*, and D17.2, *Specification for Resistance Welding for Aerospace Applications*.

"I had always wanted to achieve this certification, going back to my earlier years in the field of welding, but did not have the experience or justification to take the certification test. So, it did excite me to finally obtain and use the certification," he said.

He now aims to obtain the AWS Senior Certified Welding Inspector status and become an AWS Certified Welding Engineer.

Additional Job Experiences. Smith has enjoyed some interesting jobs as a CWI, including inspecting bridges, structures, renovations, military equipment, and aerospace products. He has learned quite a bit from every experience.

"I would encourage people aspiring to become a CWI to trust but verify information. Be humble in their welding knowledge, never stop learning about the inspection and welding processes, and always ask questions about something you don't understand, even asking the specification or code committees for clarification if needed." He's also on the AWS D1Q Subcommittee on Steel.

One of his favorite visual inspection jobs was a bridge in accordance with AWS D1.5, *Bridge Welding Code*.

"This job was site-related and required me to inspect welds on the bridge itself," Smith said. "I found this to be a memorable and exciting job because of the amount of preparation needed and the environment the job was in. I know that some may not like heights or confined locations, but it added complexity that is sometimes forgotten when some view welding inspection. Many of my other jobs were on the ground, and the area was easy to access. With this job, being hundreds of feet in the air and having to go through a manhole made the job more complex in making sure you had all the inspection tools and equipment needed."

Smith pointed out one item that will help inspectors is an inspection holster or vest to hold the necessary tools, which could include fillet weld gauges, a 10× loupe magnifier, a V-Wac gauge, a flashlight, and any other items that the job requires. He explained ensuring you have all the tools needed at your fingertips is key to the success of a job and builds confidence with the owner and/or supervisor of the job you're inspecting. It's stressful if you keep returning to the vehicle or toolbox for another tool.

"It is always good to be prepared," he pointed out.

Dreams for the Future. With so much good behind him, Smith envisions an equally bright future.

"My true goal is to increase awareness that the welding personnel are the true first inspectors on any job," Smith concluded. "Even when it is understood, sometimes it is missed that quality starts with the individual producing the weldment before anything else. I try to educate the welder while working on an inspection job instead of just inspecting and giving the weld joint an acceptable or unacceptable rating. If I walk away from a job and the personnel learn something, that fulfills me as a CWI." IT

KRISTIN CAMPBELL *(kcampbell@aws.org)* is managing editor of *Inspection Trends*.

THE ANSWER IS

BY ALBERT J. MOORE JR.

Q I have this problem at work. My employer fabricates heavy structural steel, and we're having issues with inconsistent weld quality. Our reject rate using flux cored arc welding is way too high — about 20% for fillet welds and around 10% for groove welds. With large single pass fillet welds, the biggest problems are incomplete fusion at the root and slag inclusions. With groove welds, we're experiencing incomplete fusion, rope-like weld beads, and slag inclusions. We're also seeing incomplete joint penetration when making complete joint penetration welds from both sides. "Chicken tracks" also occasionally appear on the face of both fillet welds and groove welds. What steps can be taken to improve the weld quality in our shop?

A You mentioned having problems with flux cored arc welding (FCAW). You didn't mention whether you are using a self-shielded (-S) flux cored electrode or a gas-shielded (-G) flux cored electrode. Because you said your employer fabricates heavy structural steel, it is probably safe to assume you are using a gas-shielded flux cored electrode. However, many of the recommendations I'm about to make are applicable to both FCAW-G and FCAW-S.

One problem I consistently encounter is allowing each welder to set the welding parameters based on what feels right. When you see a welder telling his team member to increase the voltage and turn down the amperage and then, after several adjustments, declaring it perfect, you have a welder setting the welding parameters based on what feels right. That's a problem.

This is not an easy question that allows for a simple yes or no answer. It's complicated. I'll answer the question with a two-part response. Part two will be in the November *Inspection Trends*.

Typical Weld Discontinuities

There are some basic steps when trying to correct a problem.

Step 1: Identify the Problem

Begin by identifying the specific issue and performing a root cause analysis. In this case, you have identified the problem as being a failure to achieve the level of weld quality necessary to satisfy the client. I would ask whether the customer's expectations are to meet the requirements of a code or if the client imposed more-restrictive requirements. That could be something as simple as a requirement for material traceability or visual weld criteria that is more stringent than AWS D1.1, *Structural Welding Code — Steel*.

Step 2: Ensure Everyone Understands the Requirements

Review your employer's quality program. Ask yourself whether it includes provisions for the additional requirements imposed by the customer. Does your employer's quality system include a mechanism to ensure everyone is aware of the code and customer-imposed requirements? "Everyone" includes the purchasing department, incoming receiving inspectors, and warehouse, inspection, and production personnel. The last group consists of the layout and fitup personnel, welders, and painters.

There may be specific requirements that the personnel in each department must be aware of. I've seen failures at each stage of manufacturing, from the purchasing department ordering the wrong material or not requesting certified material test reports (CMTRs) to receiving inspection not reviewing the ASTM specifications to compare the chemistry listed by the CMTR to that of the ASTM material specification to electrodes not being properly stored in the warehouse. I've seen raw materials not being properly segregated, resulting in cross contamination of stainless steel with carbon steel or copper alloy because the storage racks did not segregate different alloys. You name it, I've probably seen it; each represents a failure in the quality system.

Step 3: Determine Whether the Issue Is Systemic or Individual

The cause of the quality failures needs to be identified. Were failures caused by systemic problems with the quality system, or did they result from someone not doing their job? Does your employer's quality system include a mechanism to catch these deficiencies before the product is shipped, or does the customer's inspector get involved?

The quality system includes the drawings as well as the welding procedure specification (WPS). The company has to review the project specifications when working up a quote. The review should include the company's WPSs to determine whether the existing WPSs are sufficient as they are, need to be revised, or require the development of a new WPS to cover the needs of the work being quoted.

Both the drawings and WPSs are working documents used by production personnel. With some companies, the team consists of a layout person, a fitter/tacker, and the welder, who work together to fabricate a weldment. The drawings provide essential information, such as materials, dimensions, weld type, size, length, location, etc. The WPS provides the welder with essential information, including the welding process, base metal, filler metal, shielding gas, welding parameters, weld types, and geometry of the connection. The welder is expected to work within the limitations of the WPS; as such, they expect the WPS to be complete, accurate, and in an easily understood format.

The first indication that the drawings are incomplete or incorrect is when production stops so engineering can address their shortcomings. The first indication there is a problem with the WPS is when the welder doesn't review it while setting up for a new job or can't locate it when asked, "Where is your WPS?"

Step 4: Investigate Welder-Related Issues before Reassigning Work

Let's say the quality system is intact, functioning as intended, and it's established the welder is the problem. As mentioned in the post, typical weld defects include undersized welds, insufficient weld length, and weld profile issues such as undercut, overlap, slag inclusions, and elongated porosity. Where does one start to correct those deficiencies?

At first, it may seem expedient to simply assign a "better" welder to make a repair. That may take care of the immediate need, but it is an expensive, short-term solution that cuts into the company's profit margin and doesn't represent a viable long-term solution. A better approach is to determine the root cause of the unacceptable weld.

Consider the following:

- If the weld is too short, was the length marked out on the workpiece?

- If the weld is undersized, was the size marked out on the workpiece?

In the case of a fillet weld:

- Did the welder have a ruler to check the weld length?

- Did the welder have a set of fillet weld gauges to verify the size?

In the case of a groove weld:

- Was the preparation of the groove checked to verify it met the dimensions specified by the WPS?

- Was the groove filled to at least flush with the adjacent surfaces?

Size, length, grooves-filled flush: These are dimensional deficiencies that should be easily addressed if the welder checks the weld before passing it on to the next station or approving it for inspection. If they aren't checking the weld upon completion, why not? Do they know how to use the tools needed to check the weld length or size? Do they know how to check the length of the weld increment and the unwelded space between increments of an intermittent joint?

Step 5: Provide Corrective Training

Corrective action: Train the welder how to properly measure welds if it is determined they don't know how to use the tools. Don't just demonstrate the process once and walk away. Have them use the tools to accurately measure several samples.

Porosity and Other Weld Defects

Elongated porosity is one of those discontinuities that is a workmanship issue. It is cosmetic in that it doesn't look good, but it doesn't materially reduce weld strength. Elongated piping porosity is typically confined to the face reinforcement of the groove weld or the convex face of a fillet weld. It typically has a rounded bottom and rounded end conditions. The presence of elongated porosity could indicate the electrode extension is too short. If the welder increases the electrode extension, the amperage drops and the problem usually disappears. If that doesn't do the trick, slightly reduce the wire feed speed.

Piping porosity is addressed in AWS D1.1. It is the result of a gas bubble working up through the trailing edge of the solidifying weld pool while the weld is in the mushy state. It forms a hole that extends from the weld face into the weld, extending down toward the root. It reduces the weld cross section and strength. AWS D1.1 includes visual acceptance criteria for piping porosity. Welding on a rusty or painted surface, a lap joint with moisture trapped between components, or any other surface contaminant can produce piping porosity. Make sure the joint is clean and dry before welding.

A double groove weld that has incomplete joint penetration is typically caused by one of two issues: either the welder didn't back gouge deep enough or the geometry of the back gouge does not provide sufficient access for back welding (i.e., the aspect ratio of depth to width is insufficient). According to AWS D1.1, the back gouge should resemble a prequalified J- or V-groove. As for the depth, I use the following formula:

Depth of back gouge (BG) of the second side = (thickness of the base metal minus the depth of the preparation of the first side) plus an additional ⅛ in.

Or, to write it another way:

$BG_2 = (T - DP_1) + 1/8$ in.

The depth of the back gouge is easily checked with the blade of a combination square. As for the shape, one should be able to touch the bottom of the back gouge with the tip of their index finger without touching the groove face to either side. I made two gauges using the band strapping from a bundle of steel using tin snips. One gauge is the minimum size; the second gauge is the maximum size based on AWS D1.1.

When addressing weld defects like incomplete fusion, piping porosity, elongated porosity, slag inclusions, and so on, one of the things I review is the welding parameters listed by the WPS, asking the question, "Is the welder working within the acceptable ranges?" From my experience, many welders set the welding parameters based on what they always use, what they used on the last job, or what feels right. My usual response to those answers is, "Houston, we have a problem."

Coming Next

The next installment will address how to set the welding parameters for flux cored arc welding.

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Exploring Certifications and Career Advancements

In the ever-evolving world of welding, career advancement often means looking beyond the daily grind of being under the hood. For many welding professionals, certifications offered through AWS provide the perfect pathway to expand their knowledge, increase their earning potential, and extend their careers in the industry.

During a candid conversation, Daryl Peterson, quality manager at Central Maintenance & Welding, Lithia, Fla. (AWS CWI, SCWI, ASNT Level III, API 653, and SSPC PCI Level II inspector) and host Jason Becker shared valuable insights into various AWS certifications and endorsements that can help welders and welding inspectors (especially those who may find welding physically demanding or want to move into supervisory or inspection roles) take the next step in their careers.

Certified Welding Supervisor (CWS)

This certification is ideal for welders with five to seven years of experience, ready to move into management positions. The CWS program incorporates welding economics, safety, quality, and team management skills, which can significantly benefit employers.

A key example discussed was the concept of overwelding. A welder putting in more material than necessary — for instance, making a ¼ in. weld when only ⅛ in. is required — wastes resources. The experts illustrated how a weld twice the specified size can contain up to four times the amount of material, representing 300% overwelding. This excess not only wastes materials but also time and money.

The CWS program teaches supervisors to recognize and prevent these inefficiencies, making it a valuable credential for those working with manufacturers or erectors. The certification also covers areas like finding gas leaks in bulk systems and implementing lean manufacturing principles in welding shops.

JASON BECKER is an AWS CWI and CWE and owner and operator of Weld Works Training Center in Orlando, Fla.

Certified Welding Inspector (CWI)

The CWI credential is the most recognized AWS certification. Both experts agreed that obtaining the CWI credential was one of their best career moves. With a CWI certification, individuals can inspect welds, qualify other welders, and significantly expand their career opportunities. However, they emphasized that the CWI exam is challenging and requires substantial preparation. Many companies make the mistake of sending their best welder to a one-week CWI seminar with little preparation, contributing to the high failure rate for first-time test takers. The experts stressed that understanding code books, welding symbols, and standard terminology is essential before attempting the exam, and applicants should be familiar with standards such as AWS 3.0, *Standard Welding Terms and Definitions*, and A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*.

Certified Welding Educator (CWE)

The CWE certification provides an excellent credential for those interested in teaching. To obtain this certification, candidates must have a current Certified Welder endorsement and pass parts A and B of the CWI exam.

"I think that should be almost a bare minimum requirement if you're going to be a welding educator," Becker suggested. Having the CWE helps establish credibility when teaching students and provides a way for educational institutions to vet potential instructors.

Specialized Endorsements

Beyond these primary certifications, the experts discussed several specialized endorsements that can enhance a CWI's credentials. The following four are now mandatory endorsements to obtain the Senior Certified Welding Inspector (SCWI) credential:

- **Welding Performance Qualifier:** This endorsement focuses on establishing best practices for welder testing and is particularly valuable for those working with an Accredited Testing Facility.
- **Welding Procedure Qualifier:** This endorsement provides expertise in creating compliant processes for those who develop welding procedures. The experts noted that while not as difficult as the CWI exam, it still requires substantial knowledge.
- **Welding Coordination and Quality Assurance:** This endorsement provides expertise in welding quality assurance programs and the principles and practices of auditing quality management systems.
- **Nondestructive Examination Coordination:** This newer endorsement provides skills in the application of nondestructive examination (NDE) methods to meet code and customer requirements. It helps bridge the gap between AWS certifications and the NDE field.

AWS B2.1 Specification

A significant portion of the discussion centered around AWS B2.1, *Specification for Welding Procedure and Performance Qualification*, which both experts praised for its versatility. Unlike more restrictive codes, like D1.3, *Structural Welding Code — Sheet Steel*, B2.1 allows welders qualified on certain materials to work with a wide range of related materials. That broader approach makes B2.1 particularly useful in certain situations for qualifying welders across multiple material types with fewer tests, saving time and money.

The Importance of Continuous Learning

Both experts emphasized the need for continuous learning and staying updated with code changes. They shared personal experiences about discovering new information after decades in the industry, highlighting how even experienced CWIs must regularly reference code books rather than relying on memory.

Getting Involved with AWS Sections

Local AWS sections are a way to network, learn, and build relationships within the industry. These sections offer technical demonstrations, educational opportunities, and connections that can help professionals advance their careers. Becker shared how involvement in his local section, which was a long drive away for him, led to starting a new section much closer to his area, expanding access to AWS resources. They discussed the potential for satellite sections to serve areas far from existing sections, making it easier for professionals to participate.

Conclusion

For welders looking to advance their careers beyond the daily physical demands of welding, AWS certifications and endorsements offer clear pathways to growth. Whether moving into supervisory roles with a CWS, inspection roles with a CWI, teaching with a CWE, or specializing with various endorsements, these credentials provide credibility and expanded knowledge.

Obtaining these certifications requires dedication to studying, hands-on experience, and ongoing education. By choosing certifications aligned with their career goals and industry needs, welding professionals can ensure long, successful careers in the field, whether under the hood or beyond.

Welder Performance Qualifier Endorsement

Discover the details about the requirements and testing for this essential welding inspection credential

AWS QC1, *Specification for AWS Certification of Welding Inspectors*, allows for endorsements to be added to the AWS Certified Welding Inspector (CWI) and Senior Certified Welding Inspector (SCWI) certifications. Endorsements indicate additional knowledge, skill, or ability documented in writing and added to an individual's certification credential(s).

This endorsement meets the requirements for Senior Welding Inspector (SWI) Alternative Qualification in AWS B5.1, *Specification for the Qualification of Welding Inspectors*, and Alternative Certification for the SCWI in QC1.

The Welder Performance Qualifier endorsement is one of the four mandatory endorsements to obtain the SCWI credential. This endorsement assesses a candidate's knowledge, skill, and ability to conduct welder performance qualification tests. Based on AWS B2.1/B2.1M:2014-AMD1, *Specification for Welding Procedure and Performance Qualification*, the examination establishes a best practice for welder testing.

Additionally, this endorsement is one of the qualification requirements for a Qualifier per AWS QC47, *Specification for AWS Certification of Welders and Accreditation of Test Facilities*. AWS QC47 introduces electronic credentialing, real-time validation, and digital qualification tracking. AWS Accredited Testing Facilities (ATFs) play a crucial role in maintaining standards in the welding industry by providing standardized testing environments where welders can demonstrate their skills and receive official certification. The ATF program isn't limited to the United States but extends internationally, and the rigorous standards maintained by ATFs ensure that welding certifications are respected globally.


The Welder Performance Qualifier endorsement is one of the four mandatory endorsements to obtain the SCWI credential.

Endorsement Candidate Eligibility Criteria

This endorsement is available to any CWI or SCWI who wishes to receive a credential that documents their knowledge, skills, and abilities to conduct welder performance qualification tests.

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

Initial Certification or Nine-Year Recertification Eligibility

This examination is not an option for initial certification for new candidates to the CWI program. However, for

Domain	Subdomain	Percent of Questions on Exam
Domain 01 Pretest Activities	0101 Qualifier Pretest General Responsibilities	30%
	0102 Equipment and Materials Required for Testing	
	0103 Facility Requirements	
Domain 02 Conducting the Test	0201 General Requirements	40%
	0202 Welding Variables	
	0203 Fit-up and Welding of Test Coupon	
	0204 Testing Requirements	
	0205 Retests	
Domain 03 Post Test Activities	0301 Welder Performance Qualification Record (WPQR)	30%
	0302 Documentation	
	Total	100%

Table 1 — Test specifications are shown.

existing CWIs and SCWIs, successful completion of this endorsement can also satisfy the reexamination requirements for nine-year recertification, provided that the endorsement is taken during the immediate nine-year period.

Training Requirements

This endorsement does not require mandatory training. Candidates are encouraged to attend an AWS seminar or perform self-study to become familiar with the Welder Performance Qualification subject matter.

Examination Requirements

Candidates seeking the Welder Performance Qualifier endorsement shall pass an open-book examination. To study for the endorsement, candidates may use the reference books for the exam questions listed in the Examination References section (see page 16). Electronic versions of the reference books or relevant sections will be available on the computer at the test center during the exam. Candidates may also bring printed, bound copies of the reference books to the test center (photocopied books are not allowed).

Successful candidates must correctly answer 70% of the questions to receive this endorsement.

Test Specifications Examination Details

Test specifications break down the exam content areas and the proportion of the exam devoted to each content area — Table 1.

This endorsement exam consists of 50 scorable traditional multiple-choice questions and five unscorable traditional multiple-choice questions.

A Chinese language-assisted version of the exam is available. For a list of available international agents and test locations, visit *aws.org*.

IMPORTANT — The language-assisted version of the exam also consists of 50 scorable traditional multiple-choice questions and five unscorable traditional multiple-choice questions.

Pretesting

The unscorable questions are referred to as "pretest" questions that will not be scored and will not impact the examination result. This is standard practice within the high-stakes testing industry. It allows AWS to evaluate new items for content validity and statistical performance for potential use in future examinations and examination versions to have an equivalent level of difficulty and quality. These items are randomly placed within the examination and are not identifiable as pretest items.

Examination References

Most exam questions are directly answerable from the three provided reference documents. To answer these questions, candidates can either answer from memory and experience, use the electronic copy of the document provided on the testing computer, or use their own bound printed copy of the following standards to navigate to the needed information:

1. *AWS Best Practices for Performing a Welder Qualification Test* (2019 Edition).

2. B2.1/B2.1M:2021, *Specification for Welding Procedure and Performance Qualification.*

3. AWS B5.4:2005, *Specification for the Qualification of Welder Test Facilities.*

Some exam questions may be drawn from other standards that address welder performance qualification and are included in the list of informative references for self-education. For these questions, sufficient information to answer the question will be provided in the stem of the question; consulting a reference standard will not be necessary. Candidates are not permitted to bring printed copies from the "Informative References for Self-Education" list to the test location.

Informative References for Self-Education

The following is a list of informative reference books (latest editions) to assist those wishing to learn and understand the best practices for performing welder qualification tests.

1. AWS D1.1/D1.1M, *Structural Welding Code — Steel.*

2. AWS D1.2/D1.2M, *Structural Welding Code — Aluminum.*

3. AWS D1.4/D1.4M, *Structural Welding Code — Steel Reinforcing Bars.*

4. AASHTO/AWS D1.5M/D1.5, *Bridge Welding Code.*

5. AWS D1.6/D1.6M, *Structural Welding Code — Stainless Steel.*

6. AWS D9.1/9.1M, *Sheet Metal Welding Code.*

7. AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*. See Standard Welding Procedure Specifications (SWPS).

8. ASME *Boiler and Pressure Vessel Code*, Section IX: *Welding, Brazing, and Fusing Qualifications.*

9. API 1104, *Welding of Pipelines and Related Facilities.*

10. ISO 9606-1, *Qualification testing of welders — Fusion welding – Part 1: Steels.*

11. ISO 14732, *Welding Personnel — Qualification Testing of Welding Operators and Weld Setters for Mechanized and Automatic Welding of Metallic Materials.*

Section of Testing	Time in Minutes
Candidate Confirmation Page	1
Non-Disclosure Agreement (NDA)	2
Introduction & Tutorials	20
Exam Question Answering	180
Finish Page	1
Total Duration	204

Table 2 — Exam timing is highlighted.

Exam Delivery and CBT Exam Timing Information

The examination is a computer-based test (CBT) delivered at a Prometric test center — Table 2. The overall seat time allotted at the test center is 204 minutes (3.4 hours) from check-in to check-out. The time that can be used to answer questions is 180 minutes (3 hours).

Endorsement Fee Structure

For candidates in the United States and Canada, exam fees are due at the time of registration and are paid directly to AWS. For the AWS exam price list, visit *aws.org*.

Endorsement Credential

Existing CWIs and SCWIs who meet the examination requirements will be provided with a certificate, and the endorsement will appear on AWS QuikCheck and be contained in the QR code on the CWI/SCWI's wallet card.

Endorsement Renewal

This endorsement does not require renewal. It will automatically be renewed at each CWI renewal or recertification. The endorsement will continue to be listed in an approved manner.

Professional Development Hours

Candidates who successfully complete pre-exam training to prepare for the Welder Performance Qualifier endorsement examination may gain professional development hours (PDHs) in accordance with QC1 clause 16.5.

Candidates who successfully pass the Welder Performance Qualifier endorsement examination and desire to gain PDHs should contact the AWS Certification Department. IT

Discover the Value of CWI/SCWI Endorsements

AWS CWI and SCWI endorsements represent a pinnacle of achievement for inspectors seeking to deepen their knowledge, skills, and abilities and add to their credentials in the welding industry.

These specialized credentials symbolize your commitment to excellence and continuous learning and serve a strategic purpose for CWI and SCWI recertification.

In addition to the Welder Performance Qualifier endorsement, the other 13 endorsements AWS currently offers are as follows:

Welding Procedure Qualifier *(required for the SCWI credential)*

Showcase your knowledge of developing and qualifying welding procedures.

Welding Coordination and QA *(required for the SCWI credential)*

Validate your specialized knowledge in welding quality assurance and coordination and position yourself as a valuable asset to organizations seeking to optimize their welding quality processes.

Nondestructive Examination Coordination *(required for the SCWI credential)*

Demonstrate an understanding of NDE qualification and certification programs, core NDE testing methods, and key NDE coordination components and activities.

D1.1 Structural Steel

Demonstrate your knowledge in structural steel welding, covering material and design, fabrication, inspection, and qualification in the industry.

D1.2 Structural Aluminum

Demonstrate your knowledge in aluminum welding, covering material and design, fabrication, inspection, and qualification.

D1.5 Bridge Welding

Showcase your knowledge of bridge welding standards, including material and design, fabrication, inspection, and qualification.

D15.1 Railroad Welding

Demonstrate your expertise in welding railroad cars and locomotives, covering material and design, fabrication, inspection, and qualification.

D17.1 Aerospace Welding

Demonstrate your knowledge in aerospace welding, encompassing the specific requirements and standards for materials, design, fabrication, and inspection within the aerospace industry.

ASME BPVC, Section IX, Power B31.1 and Process B31.3 Piping

Showcase your proficiency in welding power and process piping systems, aligning with the rigorous standards of ASME codes.

API 1104 Pipeline Welding

Demonstrate your knowledge in pipeline welding, covering material and design, fabrication, inspection, and qualification in the industry.

This credential enhances your professional value, positioning you as a crucial asset to companies in the pipeline industry. Invest in career advancement and elevate your welding credentials with the API 1104 endorsement.

Magnetic Particle Testing of Welds

Demonstrate your knowledge in conducting magnetic particle testing of welds.

Penetrant Testing (PT Type II – Method C)

This endorsement signifies proficiency using the solvent-removable method for visible penetrant testing of welds on ferrous and nonferrous materials.

ISO Welding Standards

Demonstrate your knowledge of ISO welding standards, including material and design, fabrication, inspection, and qualification.

For more information about these endorsements, visit ***aws.org/certification-and-education***, or contact the AWS Certification Department at (800) 443-9353 or ***aws.org/contact-us***.

IT FEATURE

BY MIKE GASE

Quality Planning for Steel Construction Inspection

Learn about quality plans, inspection requirements, and best practices for steel construction projects

A site-specific quality plan (SSQP) is critical to the project's quality. It contains quality information such as seismic criteria, architecturally exposed structural steel (AESS) criteria, inspection criteria, and unique bolting, including removal of backing and run-off tabs, and tolerance criteria. It is critically important for the team to understand these issues prior to bidding or starting the work. This article provides an overview of the contract documents, codes and standards, certifications, inspection activities, and reporting for developing SSQPs. A SSQP can convey this information to minimize repairs and improve margins.

Elements of an Inspector Quality Plan

A typical quality control and quality assurance (QC/QA) inspection plan should contain the following components:

- Site safety information (getting everyone home safely);
- Field contacts (general contractor, erector, site superintendent, and detail foreman);
- Inspection timing (full-time vs. occasional);
- Quality requirements for bolting, welding, decking, and tolerances;
- Access considerations for inspections;
- Nondestructive testing (NDT) requirements; and
- Reporting and distribution procedures.

Some of the essential terms the inspector must be familiar with when establishing a quality plan are as follows:

- **Contract documents**: These documents define the responsibilities of the parties involved in bidding, fabricating, and erecting structural steel. They normally include design documents, specifications, and the contract.
- **EOR**: Engineer of record.
- **Fabricator**: The entity responsible for detailing and fabricating the structural steel (except in American Institute of Steel Construction [AISC] 303, *Code of Standard Practice for Steel Buildings and Bridges*, Section 4.5).
- **Erector**: The entity responsible for the erection of the structural steel.
- **Specifications**: The portion of the contract documents that contains the written requirements for materials, standards, and workmanship.
- **Quality Control**: Inspection performed by the fabricator or erector.
- **Quality Assurance**: Inspection by someone other than the fabricator or erector (QA verifies QC is being performed adequately).
- **AWS QC1**, *Specification for AWS Certification of Welding Inspectors*, and **B5.1**, *Specification for the Qualification of Welding Inspectors*.
- **Observe (O)**: The inspector shall observe these items on a random basis. Operations need not be delayed pending these inspections.
- **Perform (P)**: These tasks shall be performed for each bolted or welded joint or member.

Contract Document Review

Contract documents are how you get the information onto a site-specific quality plan. You must review the contract documents for quality-related items as part of an inspector's duties and the AISC certification, and if an AISC certified fabricator or erector, the AISC 207, *Standard for Certification Programs*, requires this review. When reviewing the contract documents, ensure the code dates and references are correct and the plans are reasonably developed. It is common to see one code edition referenced on the design drawing, and a different one for the project specifications. Be vigilant of these discrepancies. Additionally, ensure the inspection criteria is achievable.

Effective quality planning relies on understanding code requirements, establishing clear inspection criteria, ensuring proper qualifications, planning for access, and maintaining timely communication between all parties.

Some other common issues in contract documents include vague filler metal specifications and inspection requirements, such as "NDT at the discretion of a third-party inspector." Companies can't bid using these ambiguous requirements because they are not enforceable. Consider adding a requirement that filler metals comply with the latest edition of AWS D1.1, *Structural Welding Code — Steel*, and consider adding specific NDT requirements, not "at the third-party's discretion."

Code Standards Hierarchy

Contract documents specify legally binding codes and standards for the project, and the codes and specifications contain references that are legally binding. The hierarchy of codes and standards are as follows:

- International Building Code (IBC) is typically referenced in contracts, making it legally binding.
- IBC references AISC 360, *Specification for Structural Steel Buildings*, and AISC 341, *Seismic Provisions for Structural Steel Buildings*.
- AWS D1.1 is referenced through AISC 360; D1.8, *Structural Welding Code — Seismic Supplement* is referenced through AISC 341.

Some of the key code sections are as follows:

- AISC 303 includes AESS tolerances and commercial issues.
- AISC 360:
  - » Chapter A, General Provisions, which includes the EOR requirements.
  - » Chapter M, Fabrication and Erection
  - » Chapter N, Quality Control and Quality Assurance
- AISC 341:
  - » Chapter A, General Requirements
  - » Chapter I, Fabrication and Erection
  - » Chapter J, Quality Control and Quality Assurance
- Research Council on Structural Connections, *Specification for Structural Joints Using High-Strength Bolts*:
  - » Section 1 – EOR requirements
  - » Section 2 – Building Components
  - » Section 3 – Bolted Parts
  - » Section 4 – Joint Type
  - » Section 5 – Limit States in Bolted Joints
  - » Section 6 – Use of Washers
  - » Section 7 – Preinstallation Verification
  - » Section 8 – Installation
  - » Section 9 – Inspection
  - » Section 10 – Arbitration

AISC 360 Chapter N

AISC 360-22, Chapter N, Quality Control and Quality Assurance, forms the foundation in developing a quality plan for steel construction inspection. Chapter N is organized as follows:

- **N1. General Provisions** — EOR
- **N2. Fabricator and Erector Quality Control Programs** (QC plans and procedures for welding, cutting, and tolerances, for example)
- **N3. Fabricator and Erector Documents** — Submittal and available documents: Submit shop and erection drawings; all else must be available.
- **N4. Inspection and Nondestructive Testing Personnel** — This section addresses qualification of inspectors.
- **N5. Minimum Requirements for Inspection of Structural Steel Buildings** — This section includes the following:
  - » Inspection task tables for bolting and welding
  - » Coordinated Inspection: QC/QA may be performed by the same party.
  - » Mandatory NDT for complete joint penetration (CJP) welds in Risk II, III, and IV Category tension loaded welds
  - » UT rejection rate, reduction of UT rate, and increase in UT rate
  - » Inspection of galvanizing
  - » Other inspection tasks: the quality control inspector (QCI) verifies compliance to drawings, and the quality assurance inspector must be onsite during installation of anchor rods and other embedments.

- **N6. Approved Fabricators and Erectors** — QA may be waived with approval of the authority having jurisdiction (AHJ). QC may perform NDT; QA to review reports.
- **N7. Nonconforming Material and Workmanship** — Timely inspection and reporting.
- **N8. Minimum Requirements for Shop- or Field-Applied Coatings** — This section provides requirements for coating procedures and minimum inspection requirements.

AWS D1 Codes

The primary AWS structural welding codes inspectors use in steel construction are D1.1 and D1.8, which work together like AISC 360 and 341. Other AWS codes used are D1.3, *Sheet Steel Welding*; D1.4, *Structural Welding Code — Steel Reinforcing Bars*; D1.5, *Bridge Welding*; and D1.6, *Stainless Steel Welding*.

The contents of AWS D1.1/D1.1M:2025 are as follows:

- Clause 1: General Requirements
- Clause 2: Normative References
- Clause 3: Terms and Definitions
- Clause 4: Design of Welded Connections
- Clause 5: Prequalification of WPSs
- Clause 6: Qualification
- Clause 7: Fabrication
- Clause 8: Inspection
- Clause 9: Stud Welding
- Clause 10: Tubular Structures
- Clause 11: Strength and Repair of Existing Structures

Inspector Certification Requirements

Certification consists of many accreditations and endorsements, but for the scope of this article, we will focus on AWS and AISC certifications.

AWS Welding Inspector Certifications

The acceptable qualification criteria are as follows:

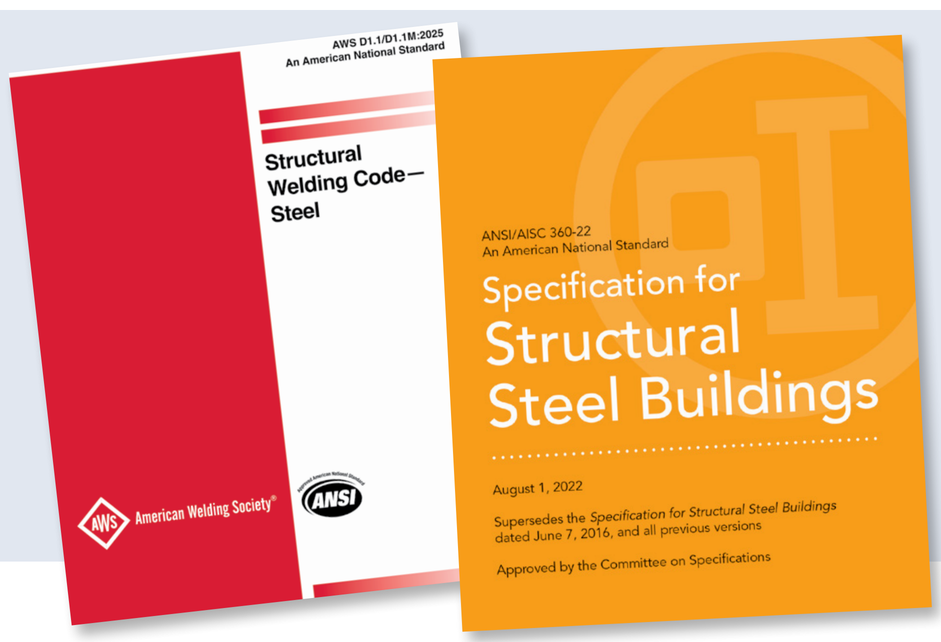
1. AWS Certified Welding Inspector (CWI) or Senior Certified Welding Inspector (SCWI) in conformance with the requirements of AWS QC1.
2. A Level 2 or Level 3 Welding Inspector in conformance with the requirements of the Canadian Standards Association Standard W178.2, *Certification of Welding Inspectors.*
3. A Welding Inspector (WI) or Senior Welding Inspector (SWI) in conformance with the requirements of AWS B5.1, *Specification for the Qualification of Welding Inspectors.*
4. An American Society of Nondestructive Testing (ASNT) SNT–TC–1A Visual Testing (VT) Level II inspector in conformance with the requirements of ASNT Recommended Practice No. SNT-TC–1A, *Personnel Qualification and Certification in Nondestructive Testing*, or ANSI/ASNT CP-189, *ASNT Standard for Qualification and Certification of Nondestructive Personnel.*
5. An individual who, by training or experience, is competent to perform the work in metal fabrication, inspection, and testing. This is one of the most critical and abused requirements. This abuse typically consists of nominal training without documentation. The training should be relevant to the QCI's task and capability, and this training should have assessment and be documented.

The purpose of this subclause is to provide a method for trainees and personnel who work to very specific tasks, for example, reviewing metal deck or only reviewing fillet welds for a product. Training should consist of a written training outline, requirements for mentoring, and an assessment test.

AISC 360 Chapter N and 341 Chapter J

The acceptable qualification criteria are as follows:

1. N4.1 Quality Control Inspector Qualifications. QC welding inspection personnel shall be qualified to the satisfaction of the fabricators or erector's QC program, as applicable, and in accordance with either of the following: (a), Associate Welding Inspectors (AWI) or higher as defined in AWS B5.1, or (b), qualified under the provisions



Two of the most essential codes for structural steel are AWS D1.1, Structural Welding Code — Steel*, and AISC 360,* Specification for Structural Steel Buildings.

of AWS D1.1/D1.1M:2025, Clause 8.1.4, Qualification of Inspection Personnel.

QC bolting inspection personnel shall be qualified based on documented training and experience in structural bolting inspection.

2. N4.2 Quality Assurance Inspectors. QA welding inspectors shall be qualified to the satisfaction of the QA agency's written practice, and in accordance with either of the following: (a) WI or SWI, as defined in AWS B5.1:2025, except AWIs are permitted to be used under the direct supervision of WIs, who are on the premises and available when weld inspection is being conducted, or (b), qualified under the provisions of AWS D1.1/D1.1M:2025. Clause 8.1.4.

QA bolting inspection personnel must be qualified based on documented training and experience in structural bolting inspection.

Pre-job Meetings

Pre-job meetings with the parties responsible for design, construction, fabrication, erection, and inspection are critical for project success. Standalone quality meetings are most effective, as they present a key opportunity to align on inspection criteria and help establish relationships with ironworkers and supervisors.

A pre-job meeting facilitates reviewing and discussing contract documents, codes and standards, certifications for QC/QA, inspection (including access, timing, and field contacts), and reporting requirements. Additionally, it's a good opportunity to understand the perspective of the ironworkers, the superintendent, and the detail foreman.

Timeliness of Inspections

Timely inspections are essential to the project's success and the safety of inspection crews. Avoid inspections after fabrication has moved out of the fitting and welding area or after an erector has demobilized from an area. It is safer and less costly to inspect and repair, if necessary, while access and crews are at the connection.

AISC 303-22, Clause 8.5, Independent Inspection, provides some helpful guidelines on the timeliness of inspections, as follows:

- The fabricator and the erector must provide access and a minimum of 24 hours' notification.
- The inspector must thoroughly inspect shop work in the fabricator's shop, if possible.
- Field inspection must be promptly completed without delaying the progress or correction of the work.
- Inspections must be timely, in sequence, and performed in such a manner as will not disrupt fabrication or erection operations.
- Rejection of material or workmanship that does not conform to the contract documents must be permitted at any time during the work's progress. However, this provision must not relieve the owner or the inspector of the obligation for timely, in-sequence inspections.

Inspection of Bolted Connections

QC and QA bolting inspection personnel must be qualified based on documented training and experience in structural bolting inspection. The International Code Council (ICC) S1 Structural Steel and Bolting certification is an option. Table N5.6-1 from AISC 360-22, Chapter N, Inspection Tasks Prior to Bolting, offers a checklist on QC/QA duties, as follows:

- Manufacturer's certifications available for fastener materials
- Fasteners marked in accordance with ASTM requirements
- Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)
- Correct bolting procedure selected for joint detail
- Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements.
- Preinstallation verification testing by installation personnel, observed and documented for fastener assemblies and methods used
- Protected storage provided for bolts, nuts, washers, and other fastener components.

Inspection of Welded Connections

The two primary codes used for structural steel welding inspection are AWS D1.1, which describes how to inspect and the acceptance criteria for welded connections, and AISC 360 Chapter N, which provides the required frequency of inspections.

Table N5.4-1 from AISC 360-22, Chapter N, Inspection Tasks Prior to Welding, offers a checklist on QC/QA duties as follows:

- Welder qualification records and continuity
- WPS available
- Manufacturer certifications for welding consumables available
- Material identification (type/grade)
- Welder identification system
- Fit-up of groove welds (including joint geometry)
- Fit-up of CJP groove welds of HSS T-, Y-, and K-connections without backing (including joint geometry)
- Configuration and finish of access holes
- Fit-up of fillet welds
- Check welding equipment

Shop and Field Inspection Drawings

QC/QA must have drawings readily available, as specified in AISC 360-22, Chapter N, Clause 5.1. These drawings must also meet any specific requirements, such as removal of backing, use of a specific filler metal, requirements for bolt tension, and any unique inspection, such as hold points, waiting for inspection, and magnetic particle testing of root pass for partial joint penetration welds.

The bolting inspector is responsible for enforcing the construction details in the approved plans and specifications for high-strength bolting of steel framing and structural steel elements.

Metal Deck and Studs Inspection

The Steel Deck Institute develops standards for the design and installation of steel decks commonly used in building floors and roofs. QC requires an AWS Certified Associate Welding Inspector (CAWI) or training and experience, and QA requires a CWI or higher (or CAWI with CWI or higher on the premises). QA also permits training and experience. Inspectors for mechanical fasteners must be qualified based on training and experience for a similar type of work.

Reporting

Some of the requirements that architectural and engineering services should expect from an inspector's report are as follows:

- Date, time, weather, inspector, area, or members reviewed
- The code worked to the level of inspector certification
- AISC 360-22, Chapter N, Clause N4, Inspection and Nondestructive Testing Personnel
- Findings for the inspection tasks noted in AISC 360-22, Chapter N, Clause N5, Tables N5.4, N5.6, and N5.7.
- A punch list, or work-off list, for any defects noted that were not corrected at the time of visit (Clause N7).

When the welders or ironworkers come in at the end of the day and see the inspectors' report, they would like to see it summarized. A punch list makes things a lot easier for the team.

UT Reporting

Any rejected weld by UT must be identified by marking directly over the flaw for its length and depth (see D1.1/D1.1M:2025, Clause 8.25.9, Indentification of Rejected Area). UT reports must meet D1.1/D1.1M:2025, Clause 8.26, Preparation and Disposition of Reports, which requires clearly identified areas of inspection, acceptance of the weld, and information on the rejection of a weld.

Report Distribution

Copies of the report must be provided to the fabricator and erector, per AISC 303. The contract documents should clearly state that all inspection reports are to be provided to the fabricator and erector on a timely basis so as not to delay operations, per AISC 360-22, Clause N7.

Conclusion

The relationship between inspectors and construction teams is vital. Effective quality planning relies on understanding code requirements, establishing clear inspection criteria, ensuring proper qualifications, planning for access, and maintaining timely communication between all parties involved in steel construction projects.

A good quality plan ensures that you and your team have reviewed the contract drawings, have the correct codes referenced, have the required personnel onsite, understand the inspection criteria, including NDT, have the access and timing with fabricator and erector input, and know the reporting requirements, including a punch list. IT

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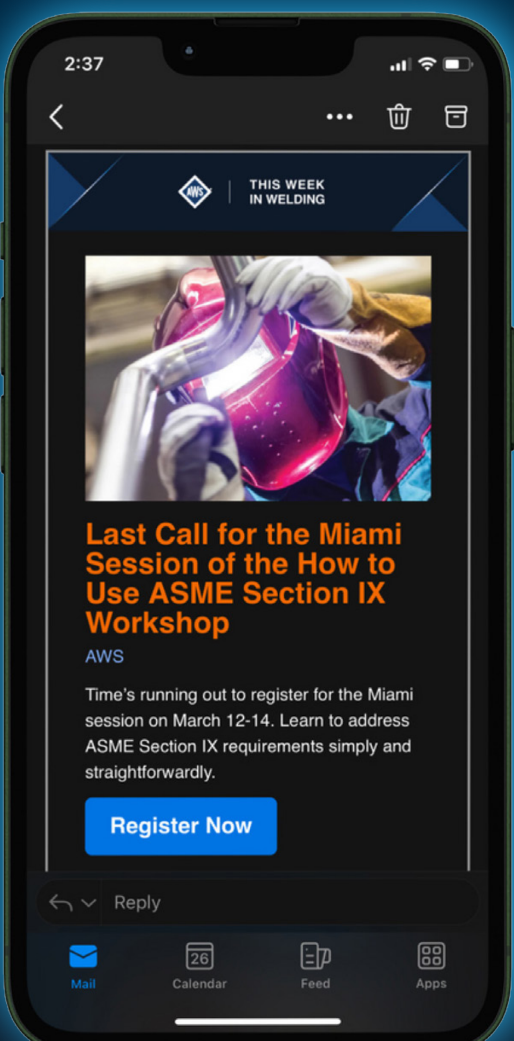

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FEATURE

BY ELIA DAMIS AND KIM JACKSON

Why Pipe Welding Quality Matters

Understanding welding discontinuities, training, teamwork, and open communication in piping fabrication for construction projects

Why does quality matter? Poor quality costs schedule, money, and harm to the industry's reputation. Poor quality can also result in safety issues, potentially harming people and property. A project that is focused on production only is susceptible to quality issues. Poor quality happens when the practices outlined in this article are not followed.

Setting the Stage

Volumetric nondestructive examination (NDE) determines the integrity of a weld throughout the entire volume and not just the surfaces we can access. Welders are not unfamiliar with phased array ultrasonic testing (PAUT) and radiographic testing (RT), as these methods are used in various code applications. However, these methods have their strengths and weaknesses regarding the probability of detection and acceptance criteria. Project initiation training for the welders, fitters, and supervisors provides significant value. When the construction group is educated on how each method can detect and size defects, they can focus on mitigating issues that may not have been considered.

Welding and Flaw Types

Each welding process comes with its own unique challenges and flaw characteristics — Table 1. Understanding what type of discontinuities to expect from the welders helps to prevent them. Similarly, when the NDE technician understands the types of discontinuities typically found, their interpretations become more accurate. Welding process, joint configuration, weld location, and type and size of weld all help to determine the type of discontinuities to expect and the best method for their detection.

When welding with a flux-containing process, such as shielded metal arc welding or flux cored arc welding, slag is created. When the welder understands the importance of cleaning between the weld beads, they are more likely to take the extra time to remove the slag prior to depositing the next pass. When welding with gas tungsten arc welding (GTAW), we would not expect to find slag but tungsten inclusions and crater cracks.

The welders' understanding of the importance of adhering to the welding procedure specification (WPS) preheat and interpass temperature requirements helps prevent hydrogen cracking. The cleanliness of the weld joint and the proper storage and handling of the filler materials also help prevent hydrogen cracking.

Typical NDE on Piping

American Society of Mechanical Engineers (ASME) B31.3, *Process Piping*, allows for two different methods of volumetric examination, RT and ultrasonic testing (UT). PAUT is not called out specifically as a requirement when used instead of RT; however, the encoded record of PAUT is highly beneficial in sizing and categorizing defects. The decision to use PAUT is often required by client specification, as this is best practice.

Arming the Welders for Success

It is critical that the training be delivered in a manner that is easily digestible and directly relatable to the piping welding scope of the project. Covering the details of the welding methods that will be used, how differing technologies work in a practical sense, and how the readouts of each technology are deciphered will provide the welding and construction team with the information to optimize the welding techniques that will be utilized.

Explaining the Code of Construction

Within ASME B31.3-2024, the primary table of interpretation is Table 341.3.2-1, Acceptance Criteria for Welds – Visual and Radiographic Examination. This table requires an understanding of a flaw type and is assessed based on the size of the flaw. Where specified, UT interpretation is described in paragraph 344.6.2 and Appendix R, Use of Alternative Ultrasonic Acceptance Criteria, for materials over 1 in. In 344.6.2, the flaw type is only categorized as linear or nonlinear. In Appendix R, fracture mechanics applies, and the flaws need not be categorized. In both cases for UT, the flaw type does not matter. Any indications found that exceed the described thresholds are grounds for failure. However, this is a disservice to construction. As mentioned above, flaws specific to each welding type are caused by different issues in the welding processes. PAUT is fully capable of determining flaw types based on echo dynamic characteristics. The position in the weld volume of these flaws can assist in pinpointing the issue — Fig. 1.

Full Cycle Information Gathering

It is essential to sit down with the welders after a reject and explain the position, morphology, and possible causes of specific flaws. Often, a welder will look at RT films or a PAUT scan and recall changing conditions or unfavorable fitups in the area where a rejection occurred.

Table 1 — Discontinuities Commonly Encountered with Welding Processes. (Adopted from AWS B1.10M/B1.10:2016,* Guide for the Nondestructive Examination of Welds.*)

Welding Process	Porosity	Slag	Incomplete Fusion	Incomplete Joint Penetration	Undercut	Overlap	Cracks
			Arc				
SW—Stud welding	X		X		X		X
PAW—Plasma arc welding	X		X	X	X		X
SAW—Submerged arc welding	X	X	X	X	X	X	X
GTAW—Gas arc tungsten welding	X		X	X	X		X
EGW—Electrogas welding	X		X	X	X	X	X
GMAW—Gas metal arc welding	X		X	X	X	X	X
FCAW—Flux cored arc welding	X	X	X	X	X	X	X
SMAW—Shielded metal arc welding	X	X	X	X	X	X	X
CAW—Carbon arc welding	X	X	X	X	X	X	X

A B

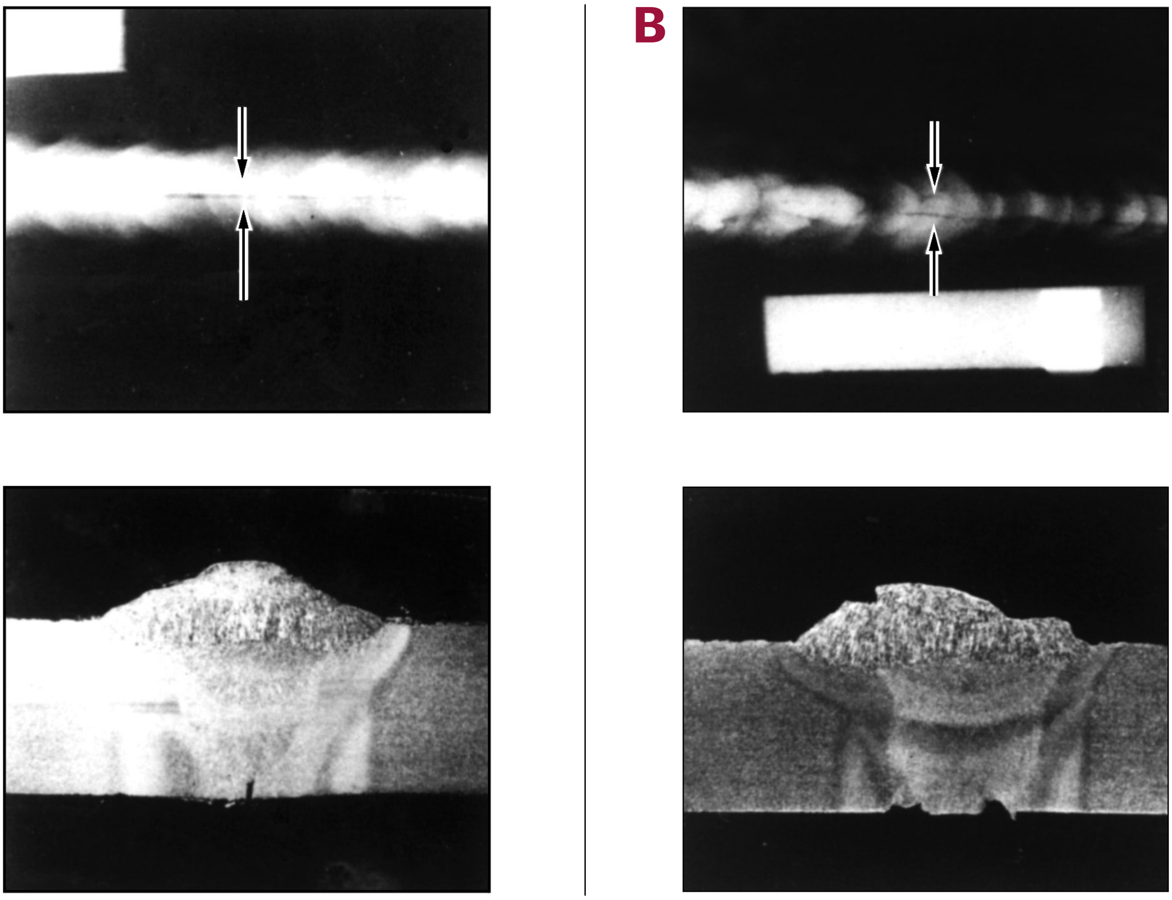

Fig. 1 — Examples of welding discontinuities found with radiography. A — Incomplete joint penetration in a weld; B — undercut at the root of a weld. (Adopted and edited from AWS Welding Handbook*, Volume 1, Tenth Edition, Chapter 14.)*

Without this feedback loop and open dialogue, poor-quality welds continue without answers about why they are happening. Even before the examination occurs, it is critical for the NDE inspectors to know what welding processes were used during the weld.

Information Is Power

All piping projects have a budget and schedule. This is no secret. Investigative NDE costs time and money, but the information gained can be priceless. Some examples are using a UT method to determine the depth of a flaw found using RT or using RT to assist in flaw characterization in coarse-grained materials where UT may not have optimized clarity. Complementary investigation has driven procedural changes in piping projects where systemic issues required a sustainable solution. Without additional information, the welding and issues would continue. Example: Feedback and demonstration to the welder of a concave root in a GTAW root pass can mean that the backing gas purge was insufficient.

Conclusion

Education of front-line fitters and welders will improve reject rates, productivity, and overall weld quality. Open and transparent communication lines foster a homogeneous relationship that does not silo groups throughout the construction process. A key factor of success is ensuring a lead NDE inspector who can educate and support the construction activities.

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FEATURE

BY MICHAEL V. McGLOIN

Unethical Decisions and Their Consequences

Why following codes of ethics is essential in the nondestructive examination industry

Quality and integrity are crucial for any industry but are especially important in nondestructive examination (NDE). For years, I have told people about the importance of NDE and how our decisions affect people's lives. I often tell students and inspectors, "When we do our jobs right, people live. When we do our jobs wrong, people die."

Deciding if a part or a weld is acceptable or rejectable is only one aspect of the importance of this industry. The ethics behind our decisions are equally important, if not more important. This is a very small industry, and one's word and integrity are all they have. Once someone is labeled unethical, they will likely have difficulty finding work in this industry.

Handling Customers and Standards

Inspectors must always stay true to themselves and the inspection at hand. Unfortunately, it is not uncommon for inspectors to find themselves in a so-called trap, where the customer or production team wants a part or weld to pass inspection and wants it now. If customers or production had their way, parts or welds would likely not even be inspected. I have told people for years, "It is production's job to get the part done, and it is our job to make sure the part is done right." Because of this, I have seen some inspectors decide to skip the inspection and simply accept a part or weld. I even argued with inspectors for accepting parts because they felt that the in-service stresses were very low and the part was built very strongly. Therefore, what is the point in even inspecting the part?

Indeed, parts and welds are often built to withstand a higher stress than the intended service, but determining that is not our job as inspectors. As inspectors, we are getting paid to inspect a part or weld regardless of the intended service and design strength. I remember setting up to inspect welded tubes and another inspector telling me, "Don't bother inspecting those parts; those parts are always good." At that moment, I realized those parts were always good because this inspector had probably never inspected one — a scary notion. These tubes were inspected before and after heat treatment, and when I got a batch to inspect after postweld heat treatment, one weld was only tacked. When I looked to see who had inspected them before heat treatment, it was none other than the inspector who'd told me that the parts were always good. That inspector never did inspect any of them. After I rejected the tube, it had to go back to welding, inspection, heat treatment, and back to inspection. Talk about a massive waste of time and energy, just because an inspector decided not to do the job they were getting paid for. My concern was, what if that inspector inspected it the second time, meaning that they just stamped it off, and it went into service? This was a critical aircraft part; if it had failed in service due to a missing weld, it could have brought down the aircraft.

The most egregious ethics violation I have seen in this industry is people accepting parts without inspecting them, as in the example above. I have also seen documents forged, such as classroom training certificates, experience records, certification records, and even the American Society for Nondestructive Testing (ASNT) certificates. Years ago, I was asked how to ban an inspector from the industry over the ethics violations the inspector committed, ultimately leading to the company's closure. I told the person that I wish there were a process for it. When I served on the board of directors for ASNT, banning inspectors from the industry was a discussion we also had.

Stamp Importance

In aerospace, it is common for inspectors to use a stamp as opposed to physically signing the paperwork that accompanies the parts. I often encounter inspectors who do not understand that the stamp is their signature. Inspectors usually think, "It's just a stamp," and do not realize its importance. They do not understand that everything they stamp, sign, or fill out becomes a legal document and can be called into evidence in a court of law if something happens and the company gets sued. Inspectors are not likely to get sued themselves, but that does not mean they will not end up on the stand in front of a judge, jury, and a grieving family, defending what they did. Most Certified Welding Inspectors (CWIs) understand the importance of their stamp, but I have still seen some who do not.

Another factor that has occurred is somebody using somebody else's stamp. When people do this, they are not only committing fraud by using somebody else's stamp; they are also committing identity theft because when they stamp the paperwork, they are stamping it as another person. One NDE manager told me of a time they noticed a specific inspector's stamp on some paperwork for parts currently being processed through the plant. The issue was that the inspector was on vacation at the same time the stamp was being used. When the manager investigated it, they discovered that the inspector gave their stamp to a trainee (an uncertified individual) and told them to stamp the paperwork while the inspector was on vacation.

Code of Ethics and Integrity

Early in my career as a field radiographer, I worked for many CWIs. When I achieved CWI status, I also had multiple ASNT Level IIIs. When I started applying for CWI jobs, I was repeatedly turned down, and the most common reason was that companies did not want a CWI who was also an ASNT Level III because as an ASNT Level III, we must sign a code of ethics, which makes us "too ethical." Many companies do not realize that CWIs also sign a code of ethics. However, I understood what those companies meant because when I worked for those CWIs, I saw many of them accept parts or welds that they knew should have been rejected or reinspected. Granted, this was over 30 years ago, but at the time, there was a negative stigma associated with CWIs in that several of them had performed jobs unethically. What makes it worse is the customer wanted a CWI that was somewhat unethical as opposed to someone who was "too ethical." To me, this is a very scary thought. We must always act with integrity and ethics. It seems to me that people often forget the importance of what we do. Just because an inspector has never heard of one of their parts/welds failing in service does not mean it has never happened.

"When we do our jobs right, people live. When we do our jobs wrong, people die."

On the other hand, some inspectors have seen their parts stressed beyond the limit and the parts have held. I remember watching a pipe assembly I inspected in a refinery being lifted incorrectly by one crane instead of two. When the crane operator set the pipe down, he had a 120-ft-tall "U" instead of a straight run. All I could think of the whole time was, "At least my weld held."

When applying to become a CWI, the applicant must sign and agree to follow a code of ethics. This is a common practice for any organization that issues certifications. As mentioned earlier, ASNT has its code of ethics for the certifications it issues, and the American Petroleum Institute has its code of conduct. The International Code Council (ICC) also has a code of ethics for each individual participating in any ICC activity. A lot of societies even have a code of ethics, or code of conduct, for the members of the society, and violating that code could lead to that individual losing their membership and the benefits of being a member.

In Closing

Overall, there is not enough education on the topic of ethics. Due to this, some aerospace primes, such as Rolls-Royce, have mandated that any company that engages with them must have an ethics policy that all personnel involved in NDE must sign and agree to. This is an excellent way of enforcing ethics; every inspection company should do it with all of its employees. This industry is so important, and I am still amazed when people make unethical decisions. Inspectors need to be true to themselves and be true to the inspection. The most essential thing in this industry is remembering what we do. "When we do our jobs right, people live. When we do our jobs wrong, people die." IT

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IT FEATURE

BY JORGE REYNA

Inspection of Coatings Applied over Welds

The challenges of weld coatings, weld preparation, and the critical role of NACE SP0178

Welded structures are essential to the integrity of assets in sectors such as oil and gas, energy, marine infrastructure, and heavy construction. While welding quality is often under strict scrutiny, the protective coatings applied over welds frequently receive less attention, despite being equally critical in preventing corrosion and extending service life. The interaction between weld geometry, metallurgical changes, and coating performance presents unique challenges that require a dedicated inspection approach.

One of the most effective tools for addressing these challenges is the application of standards such as National Association of Corrosion Engineers (NACE) Standard SP0178, *Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service*, which provides guidance for weld surface preparation prior to coating. (NACE is now the Association for Materials Protection and Performance [AMPP].)

Why Coating Welds Is a Unique Challenge

Unlike flat or uniform steel surfaces, weld zones exhibit distinct characteristics that can compromise coating performance if not properly treated. These include the following elements:

- **Irregular geometry** from weld beads and overlaps that lead to uneven coating thickness;
- **Surface roughness and sharp edges**, which cause thin film build-up or localized mechanical stress;
- **Residual contaminants**, such as spatter, slag, or oils, that reduce coating adhesion and lead to premature failure; and
- **Metallurgical effects**, including heat-affected zones, which may react differently to surface preparation or coating materials.

These challenges are especially critical in environments involving immersion, chemical exposure, or extreme humidity, where the coating is the first and often only barrier against aggressive corrosion mechanisms.

The Importance of Standardized Surface Preparation

NACE SP0178, originally developed for tanks and vessels intended for lining, offers industry guidance that is applicable far beyond its initial scope. The standard emphasizes the need for weld surfaces to be prepared to a quality level that aligns with the intended service conditions and coating system performance. Rather than leaving surface preparation to subjective interpretation, SP0178 promotes a consistent, engineering-based approach to determining whether a weld is ready for coating.

By defining expectations for weld appearance, cleanliness, and smoothness prior to coating application, this standard helps to close the communication gap between welding, coating, and inspection teams. When referenced in project specifications, SP0178 can serve as a benchmark to reduce ambiguity and avoid disputes over acceptability criteria, particularly in international or multicontractor projects where alignment across disciplines is crucial.

Inspection Strategies for Coated Welds

Coating inspection over welds should be treated as a specialized task, not just an extension of flat-surface procedures. It involves multiple steps:

- **Visual examination** of welds before coating to detect discontinuities such as undercut, porosity, or excessive convexity that could compromise coating integrity.
- **Verification of surface preparation**, including blast cleanliness (e.g., SSPC-SP 10 Near-White Metal Blast Cleaning/NACE NO. 2) and surface profile, to ensure proper mechanical adhesion.
- **Environmental condition monitoring**, including substrate temperature, ambient humidity, and dew point, to prevent flash rusting or poor curing.
- **Dry film thickness measurements**, which must consider the complex geometries of welds and ensure sufficient coverage in recessed or angular areas.
- **Holiday testing** using low- or high-voltage methods, particularly in immersion service or critical containment areas, to detect voids or discontinuities in the coating.

Each of these steps must be executed with knowledge of both welding and coatings. For instance, understanding weld symbols and joint configurations helps inspectors anticipate problem areas. Similarly, awareness of coating system limitations informs decisions about acceptable surface conditions and necessary corrective actions.

Toward Better Integration of Disciplines

The push toward multidisciplinary inspection roles is growing. Today's inspectors are increasingly expected to be familiar with welding codes and coating standards, particularly when working on infrastructure exposed to demanding environmental conditions. Integrating knowledge from both fields is not only beneficial, it is often essential.

"The interaction between weld geometry, metallurgical changes, and coating performance presents unique challenges that require a dedicated inspection approach."

Using NACE SP0178 as part of the inspection workflow, for example, enhances consistency, traceability, and confidence in long-term coating performance over welded substrates. It helps engineers and inspectors ensure that coating failures do not originate from the weld interface — a historically vulnerable and often neglected zone.

Incorporating this standard into fabrication, painting, and quality assurance processes contributes to a higher standard of corrosion protection and structural reliability — two objectives central to modern asset integrity management. IT

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Want to know more about welding and coating inspection?

Attend the upcoming **AWS webinar** aimed at connecting welding and coating inspection expertise, addressing the increasing industry demand for inspectors with cross-disciplinary skills. The training will provide a comprehensive guide to navigating the shift from welding inspection to coating inspection, highlighting key differences, complementary practices, and strategies to improve collaboration.

The webinar is approximately eight hours long, comprising two-hour sessions spread across four days. The first session will be on **November 11 and 13**, and the second will be on **November 18 and 20**.

Registration details are available at ***aws.org/certification-and-education/education/online-instructor-led-learning***.

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Webinar Examines NDE's Role in Bridge Preservation

The webinar "Bridge Preservation Using Non-Destructive Testing on T1 Steel" explores how nondestructive examination (NDE) techniques support informed decision-making in bridge preservation, specifically for structures built with Grade 100 steel. Through real-world case studies, presenters share how NDE has been used in long-term structural monitoring, highlighting key aspects such as project procurement, scoping, work progression, major findings, and lessons learned. Viewers will gain insights into the practical application of NDE, including critical challenges and considerations encountered during the projects, and understand how NDE is integrated into the bridge preservation process with a focus on evaluating and maintaining Grade 100 steel structures. Topics covered include Kentucky Transportation Cabinet NDE of Grade 100 steel; NDE and remediation plans for T-1 steel members; and use of NDE to assess, evaluate, and validate welds in T-1 steel. The 90-minute webinar is available at *webinar.mytrb.org/Webinars/Details/1869*.

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