2019 WINTER/SPRING
PRODUCTS AND SERVICES CATALOG
Publications, Membership, Professional and Career Development Programs, Expositions, and more
New in this Catalog

B2.1-1-016:2018, Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1/S-1, GROUP 1 or 2), 1/8 Through 1-1/2 Inch Thick E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications see page 48

B2.1-1-017:2018, Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1/S-1, GROUP 1 OR 2), 1/8 Through 1-1/2 Inch Thick, E6010, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications see page 48

B2.1-1-019:2018, Standard Welding Procedure Specification (SWPS) for CO2 Shielded Lux Cored Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 Through 1-1/2 Inch Thick, E70T-1 and E71T-1, As-Welded Condition see page 48

B2.1-1-020:2018, Standard Welding Procedure Specification (SWPS) for 75% AR/25% CO2 Shielded Flux Cored Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 Through 1-1/2 Inch Thick, ER70S2 and E7018, As-Welded or PWHT Condition see page 48

B2.1-1-021:2018, Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 Through 1-1/2 Inch Thick, ER70S2 and E7018, As-Welded or PWHT Condition see page 48

B2.1-1-022:2018, Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8 Group 1) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, in the As-Welded Condition, Primarily Plate and Structural Applications see page 48

B2.1-1-026:2018, Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 Through 1-1/2 Inch Thick, E6010 (Vertical Uphill) Followed by E7018, As-Welded or PWHT Condition see page 48

AWS PGVE – Pocket Guide for Visual Examination of Welds – Discontinuity Causes and Remedies (APG-DIS) see page 25

Welder Log Book see page 42

C2.23M/C2.23:2018, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel see page 62


D17.2-2019, Specification for Resistance Welding for Aerospace Applications see page 67

WHB-1.10 Welding Handbook Volume 1 – Welding Science and Technology (AWS WHB-1.10) see page 51

D17.1/D17.1M:2017 AMD1, Especificacion De La Soldadura Por Fusion Para Aplicaciones Aeroespaciales (Spanish) see page 67

G2.3M/G2.3:2019, Guide for Joining of Wrought Solid Solution Austenitic Stainless Steels see page 80

Welding Replica Set (RWK-A: REPLICA WELDING KIT) see page 42

Pelican Case for the RWK-A Welding Replica Set see page 42
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Certification Programs for Individuals

Certified Welder (CW)
The AWS Certified Welder program is designed to provide widely recognized credentials to professional welders who have demonstrated a higher skill level demanded by industry.

Certified Welding Inspector (CWI)
The AWS Certified Welding Inspector program confirms your skills and expertise in welding inspection according to the high standards required and outlined in the AWS B5.1, Specification for the Qualification of Welding Inspectors standard.

Senior Certified Welding Inspector (SCWI)
This level represents the pinnacle of being a welding inspector. The “Senior” can additionally supervise other inspector levels, write welding procedure specifications, test and qualify welders, prepare inspection reports, and review and interpret joining procedures.

Certified Associate Welding Inspector (CAWI)
Earning a CAWI gives you the opportunity to document your current skills, while gaining a valuable hands-on experience from a current CWI to help you make it to the next level.

Certified Welding Supervisor (CWS)
Earning an AWS Certified Welding Supervisor certificate shows you are committed to safety, quality, and productivity in the fabrication process and identifies you as a candidate with the knowledge and skills to save companies money. With these valuable skills you can expand your career and gain professional prestige that puts you among the industry’s elite.

Certified Welding Educator (CWE)
The AWS Certified Welding Educator program was developed to define the standards for welding educators. AWS CWEs are able to direct and perform operations associated with welder training and classroom instruction.

Certified Welding Engineer (CWEng)
AWS Certified Welding Engineer professionals are capable of directing operations associated with weldments and other types of joints to ensure satisfactory results, completed in accordance with appropriate contract documents, purchase orders, codes and all other standards.

Certified Radiographic Interpreter (CRI)
The AWS Certified Radiographic Interpreter program certifies the ability of individuals to properly assess welding-related indications produced on radiographic film and related media. If your job responsibilities include reading and interpretation of weld radiographs, this program is designed for you. You’ll learn how to identify proper film exposure, correct selection of image quality indicators, characterization of indications, and use of acceptance criteria as expressed in the AWS, API, and ASME codes.

Certified Robotic Arc Welding Technician/Operator (CRAW-T/CRAW-O)
The AWS Certification Program for Robotic Arc Welding - Operators and Technicians (CRAW) allows many welding personnel employed in various welding sectors to measure themselves against standards for their occupation. It also signifies that the CRAW Operator or Technician has demonstrated the capability of working with various codes, standards, and specifications. The examination tests applicants’ knowledge of welding processes, welding procedures, destructive and non-destructive tests, welding terms, definitions, symbols, reports, safety, quality assurance and responsibilities, robot programming and robot arc welding, and other related subjects.
Certified Welding Sales Representative (CWSR)
The AWS Certified Welding Sales Representative (CWSR) program requires documentation of experience, satisfactory completion of an examination, and proof of visual acuity. The examination tests the supervisor’s knowledge of welding processes, welding procedures, destructive tests, terms, definitions, symbols, reports, safety and responsibilities. The CWSR positions you as one of the industry’s top professionals. The AWS Certified Welding Sales Representative program ensures that the welding industry knows you bring years of expertise and insight to every recommendation and sale you make — and that your continued commitment to learning keeps your knowledge and skills at their peak.

Endorsement Programs for Individuals
Specification for AWS Certification of Welding Inspectors, provides for endorsements that may be added to the CWI and SCWI certifications. Endorsements are defined in AWS QC1 as the approval of an additional skill documented in writing and added to a certification credential.

D1.1 Structural Steel Welding Code Endorsement
This endorsement covers four subject areas in AWS D1.1, material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

D1.2 Structural Aluminum Welding Code Endorsement
This endorsement covers four subject areas in AWS D1.2, material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

D1.5 Bridge Welding Code Endorsement
This endorsement covers four subject areas in AWS D1.5, material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

D15.1 Railroad Welding Specification for Cars and Locomotives Endorsement
This endorsement covers four subject areas in AWS D15.1, material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

D17.1 Specification for Fusion Welding of Aerospace Applications Endorsement
This endorsement covers four subject areas in AWS D17.1, material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

AWS Penetrant Testing (PT Type II - Method C) Endorsement
This endorsement shall govern visible Penetrant Testing (PT) of welds using the solvent removable method in ferrous and non-ferrous materials manufactured from non-porous materials.

AWS Magnetic Particle Testing (MT Dry Powder Yoke Method) Endorsement
This endorsement shall govern Magnetic Particle testing (MT) of welds in ferromagnetic materials using an electromagnetic yoke with visible dry powder.
API 1104 Welding of Pipelines and Related Facilities Endorsement
This endorsement covers four subject areas in API 1104, material and design, fabrication, inspection, and qualification, including Appendix A and B. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

ASME Pressure Vessel Section IX, Pressure Piping B31.1 and B31.3 Endorsement
This endorsement covers four subject areas in three ASME standards: material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

ASME Pressure Vessel Section VIII, Div. 1 and Section IX Endorsement
This endorsement covers four subject areas in two ASME standards, material and design, fabrication, inspection, and qualification. Subject weights for each of these areas are in conformance with the codebook examination requirements as expressed in section 7.1 of AWS B5.1, Specification for the Qualification of Welding Inspectors.

AWS Structural Bolting Inspection - Building Structures Endorsement
This endorsement shall govern the written examination for structural bolting inspection.

AWS Structural Drawing Reading - Building Structures Endorsement
This endorsement shall govern the written examination for structural drawing reading.

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**2019 Price List**

**INSPECTOR (CAWI, CWI, SCWI)**

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<th>Member</th>
<th>Non-Member</th>
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<td>Initial CAWI, CWI Exam</td>
<td>$950</td>
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<td>CWI by Reciprocity with CBW or INWC</td>
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<td>Upgrade CAWI to CWI</td>
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- Prometric Endorsement Exam ^^ $370 $625
- Prometric Endorsement MT Exam^ $430 $690
- Prometric Endorsement PT Exam^ $430 $690

Endorsement MT/PT Exam Part B ^ Contact ATF for pricing

**CERTIFIED WELDING EDUCATOR (CWE)**

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**AWS SENSE PARTICIPANTS ONLY**

- Exam $310 $565
- Retest $355 $610
- Retest (Single Part) $310 $310***
- Renewal CWE Only $225 $480

**CERTIFIED RADIOGRAPHIC INTERPRETER (CRI)**

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**CERTIFIED WELDING SUPERVISOR (CWS)**

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**PACKAGES**

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<td>- CWI Pre-Seminar(online course)</td>
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## Professional and Career Development Resources

### AWS Certification, Endorsement, and Accreditation Programs

#### CLINICS / SEMINARS / WORKSHOPS (EXAM NOT INCLUDED)

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#### RENEWAL

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<td>C/WB or INWC Renewal by Reciprocity</td>
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#### 9-YEAR RECERTIFICATION MT/PT

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<td>Endorsement MT/PT Exam (Part B)^ Contact ATF for pricing.</td>
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#### CERTIFIED WELDING SALES REPRESENTATIVE (CWSR)

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#### CERTIFIED WELDING ENGINEER (CWEng)

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#### CERTIFIED ROBOTIC ARC WELDING (CRAW)

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* Non-Member price includes a 3-year AWS Individual Membership unless otherwise noted.

** Non-Member price includes a 1-year AWS Individual Membership.

*** No additional membership included with this price.

^ Additional ATF fees will apply for the practical exam (part B). Prices reflect a $60 seat fee per part for Prometric initial and/or reexam endorsements. Contact the ATF for Pricing.

^^ Price is for all endorsements except Structural Drawing Reading.

For a complete price list of our online courses please visit awo.aws.org. Some online courses can be combined with other certification programs.

**Note:**

Prices are subject to change without notice.

Full payment must be received with your completed application or it will not be processed.

All checks, money orders and demand drafts must be made payable to: **American Welding Society**
Accreditation Programs for Companies

Accredited Test Facility (ATF)
The AWS Accredited Test Facility (ATF) program establishes minimum requirements for test facilities and their personnel and equipment, to qualify for accreditation to test and qualify welders. Facilities earning an AWS ATF play an integral part in the operation of the AWS Certified Welder program. These highly dedicated facilities have the necessary resources to test welders to this nationally recognized and accepted program.

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<tr>
<td><strong>MP/PT Fees</strong></td>
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<tr>
<td>On-site Audit**</td>
<td>$1100</td>
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*Fees are subject to change due to individual circumstances for each facility. **Applicants are directly responsible for the auditor’s travel expenses. ***Auditor fees for international ATFs are as follows:

Each Travel Day $400  | On-site Audit Fee $800
Total Fee (dependent on # of audit and travel days required)

Lesser price shown is for AWS members.
Always get the best price from the source: 1-888-WELDING (935-3464) Option 1
Approved Testing Center (ATC)
The AWS ATC program was designed to complement the AWS Certified Robotic Arc Welding (CRAW) program by offering companies with robotic arc welding equipment the opportunity to test Certified Welding Inspectors (CWI) and Welders for the CRAW Operator and CRAW Technician certifications at their facility.

There are currently no up-front application fees for the ATC program; however, ATC applicants are responsible for auditor’s fees and travel expenses.

Certified Welding Fabricator (CWF)
The AWS Certified Welding Fabricator (CWF) program recognizes companies that have the resources, procedures, and personnel to apply a quality management system to their welding fabrication activities. An appropriate welding quality system is the foundation of delivering a quality welded product or service. When designed for the welding fabricator’s unique products and suitably committed to paper and practice, the daily manufacturing operations of the welding fabricator are more consistent and traceable when problems arise. This program is an affordable alternative or complement to ISO, AISC, NADCAP, and ASME quality certification.

<table>
<thead>
<tr>
<th>Initial Audit Fees</th>
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<tr>
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<tr>
<th>3rd Year Recertification Audit Fee</th>
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<tr>
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<td>$600</td>
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<tr>
<td>On-site Audit**</td>
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<td>$600</td>
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<tr>
<td>Total</td>
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<td>$1200</td>
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<tr>
<th>AWS Certification for AISC Accredited Fabricators</th>
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<tr>
<td>Renewal Application (annual)</td>
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*Fees are subject to change due to individual circumstances for each facility. **Applicants are directly responsible for the auditor’s travel expenses. ***Auditor fees for international CWFs are as follows:

Each Travel Day $400  |  On-site Audit Fee $800
Total Fee (dependent on # of audit and travel days required)
Plastics Conference
AWS developed this conference featuring the latest advances in manufacturing, fabrication, installation and examination related to thermoplastics welding and joining.

Date: April 30, 2019  
Location: NACE International Headquarters, Houston, Texas 77485  
Registration Fee:  
Early Bird (Before March 15, 2019) $175 $275  
Regular $275 $375

2019 Welding Industry Summit
This Summit is designed to elevate the Industry’s concern by welcoming the open debate, and provide each attendee with more knowledge, skills, and industry contacts than the year before!

Date: August 2019  
Location: Houston, Texas  
Registration Fee:  
Early Bird (Before September 1, 2019) $375 $475  
Regular $475 $575

Shipbuilding/Aluminum Conference
Industry experts will deliver the latest research and innovations in both the Shipbuilding and Aluminum industries. Aluminum is one of the most versatile and widely used metals in manufacturing, but its unique chemical and physical properties can also make it one of the most challenging to weld. The critical importance of welding in the shipbuilding industry will also be addressed by providing current information on emerging technologies being developed for shipbuilding applications. Due to the overlap in technology we are combing these two events to the same week, and same hotel! Please take advantage by purchasing the combination registration package that gives you access to both technical programs.

Date: September 17-19, 2019  
Location: Intercontinental New Orleans, New Orleans, LA  
Registration Fee:  
Early Bird (Before May 1, 2019) $575 $705  
Regular $675 $805  
Combo (Before May 1, 2019) $1000 $1250  
Combo $1250 $1600
Aerospace Joining Conference
Bringing together experts from Research & Development, Manufacturing and Applications in the areas of advanced welding and brazing, adaptive manufacturing, single crystal repair and advanced repair technologies for the aerospace and IGT engine industries.

Date: **September 23-26, 2019**  
Location: **Hyatt Regency Columbus, Columbus, OH**

<table>
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<tr>
<td>Student</td>
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Inspection Conference
Be among the first to attend the inaugural Inspections Conference, where experts from AWS, AISC, ASNT and NACE join forces on a comprehensive array of topics common to corrosion engineering, nondestructive testing, steel construction and welding inspectors. Learn tips, technology and resources to improve the quality of your plans, drawings and documentation, visual inspections, procedures and testing processes.

Date: **January 21-23, 2020**  
Location: **Hyatt Regency Houston, Houston, Texas**

<table>
<thead>
<tr>
<th>Registration Fee:</th>
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<tbody>
<tr>
<td>Early Bird (Before August 1, 2019)</td>
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<td>Regular</td>
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<tr>
<td>Student</td>
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</table>

International Brazing and Soldering Conference
The 2020 International Brazing and Soldering Conference will bring together experts from all over the world to discuss the latest in research and development within the brazing and soldering industry.

Date: **March 15-18, 2020**  
Location: **The Curtis – A Doubletree by Hilton, Denver, CO**

Registration will open in March 2019

<table>
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<tr>
<th>Registration Fee:</th>
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<tr>
<td>Guest Ticket for Awards Reception</td>
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</table>
The seminars that AWS offers will give you the tools you need to make the most out of your welding career. Whether you’re looking for better opportunities, or fulfilling company requirements, our wide range of seminars will help you take your welding career to the next level.

**Certified Welding Inspector Seminar**
The AWS Certified Welding Inspector seminar is an intensive review of welding inspection science, documentation, and techniques. This six-day seminar assists practicing welding inspectors in mastering the Body of Knowledge that corresponds to the CWI Exam. Length: 5 days

| Member Rate: | $2185 |
| Nonmember Rate: | $2418 |

**Certified Welding Inspector 9-Year Recertification Seminar**
As an AWS Certified Welding Inspector or Senior Certified Welding Inspector, you must renew your certification every three years. Every nine years, you must recertify, either by examination, obtaining approved endorsements, by recertification course, or by demonstrating 80 hours of continuing education, along with other requirements. Neglecting to recertify prior to your expiration will result in the loss of your certification status and will require you to retest on all parts of the original exam to regain your certification. Length: 7 days

| Member Rate: | $1705 |
| Nonmember Rate: | $1938 |

**Certified Radiographic Interpreter Seminar**
The five-day AWS Certified Radiographic Interpreter (CRI) Seminar is designed to ensure that individuals have the knowledge to properly assess indications produced on radiographic media of weldments or adjacent base metal. It will prepare you for the CRI Certification exam, which is given at the end of each seminar week. Length: 5 days

| Member Rate: | $1407 (seminar only) / $1758 (seminar + exam) |
| Nonmember Rate: | $1640 (seminar only) / $1991 (seminar + exam) |

**Custom Seminars**
AWS on-site training can make life less complicated and more rewarding for your company and your employees. Get a guaranteed combination of superior education plus convenience and affordability with one of our customized seminars. Duration and rates: TBD upon consultation with AWS

*Lesser price shown is for AWS members.*

*Always get the best price from the source: 1-888-WELDING (935-3464) Option 1*
Certified Welding Inspector Pre-Seminar  Approx. 80 hrs. / 80 PDHs  $750 / $750

Welding Supervisor Seminar  Approx. 84 hrs / 84 PDHs.  $1245 / $995
This seminar covers the wide range of management skills, welding processes, and welding economics required to plan, staff, monitor, and safely deliver welding projects according to schedule and budget. It is comprised of seven engaging, multimedia courses, totaling 84 hours of instruction.

Welding Sales Representative Seminar  Approx. 23 hrs / 23 PDHs.  $600 / $450
Presented in 12 interactive and engaging modules, this online seminar is perfect for both inside and outside salespeople, distributors, supervisors, and managers who want to gain a technical understanding of welding principles, methodology, equipment, consumables, and variables.

8 Week CWI Seminar  $2098 (+$2400 deposit) / $1865 (+$2400 deposit)
The 8-Week Online CWI Seminar is designed to prepare participants for the AWS Certified Welding Inspector Exam from the comfort of their own homes. Students meet online twice per week for an interactive, two-hour session with an AWS instructor. All materials are included. Students receive books, practice tests, and inspection tools prior to the start of the course (yours to keep) and a set of plastic weld replicas for the Part B: Practical portion of the seminar (to borrow and return to AWS). Students also have access to online resources one month before and after the seminar.

Welding Fundamentals I  Approx. 14 hrs / 14 PDHs.  $470 / $350
A comprehensive overview of the basic principles of welding, including the science and practical application of the most commonly utilized welding and cutting processes. Topics include welding terminology, weld design, welding safety, electrical theory, the weldability of metals, and welding quality control.

Welding Fundamentals II  Approx. 7 hrs / 7 PDHs.  $265 / $210
A comprehensive overview of resistance welding, plasma arc welding, electron beam welding, and laser beam welding, cutting, and drilling. Topics include the science, equipment, consumables, process variables, safety precautions, and advantages and disadvantages inherent to each process.

Welding Fundamentals III  Approx. 5 hrs / 5 PDHs  $180 / $150
A comprehensive overview of commonly utilized brazing and soldering processes. These processes include torch, furnace, dip, and induction brazing, as well as iron, torch, furnace, dip, and wave soldering. Presented in short, easy-to-understand modules, this multimedia course covers the science, equipment, consumables, process variables, safety precautions, and advantages and disadvantages inherent to each process.

Safety in Welding  Approx. 3 hrs.  FREE
An extensive overview of welding safety in an accessible and engaging format. Topics include welding hazards, safety equipment, ventilation, welding in confined spaces, and safety precautions and specifications. Access to the PDH's and Certificate of Completion requires a $99 payment.
Fabrication Math I  Approx. 18 hrs. / 18 PDHs  $510 / $385
This introduction to basic math skills provides clear, step-by-step explanations that make each concept easy to understand and remember. Topics include place value estimation, measurement, and the addition, subtraction, multiplication and division of whole numbers, fractions, decimals, and mixed numbers.

Fabrication Math II  Approx. 15 hrs. / 15 PDHs  $495 / $370
Fabrication Math II builds upon the lessons learned in Fabrication Math I to explain the concepts and formulas that welders, welding supervisors, and other welding professionals require to plan and produce quality welds. Topics include percentages and ratios, order of operations, area and volume, and U.S./metric conversions.

Understanding Welding Symbols  Approx. 10 hrs. / 10 PDHs  $400 / $300
This in-depth course employs clear language, audio narration, and animated graphics to convey the principles of this often complex topic in short easy-to-understand modules.

Metallurgy I  Approx. 6 hrs. / 6 PDHs  $235 / $175
This multimedia course employs clear, simple terms, audio narration, and animated graphics to describe the basic principles that underlie the broad field of metallurgy. Concepts covered include the anatomy of atoms, the periodic table, chemical bonding, chemical reactivity, the atomic structure of materials and the properties of metals.

Metallurgy II  Approx. 6 hrs. / 6 PDHs  $235 / $175
Metallurgy II builds on the principles described in Metallurgy I to provide a basic understanding of the nature of metals and the properties that affect weldability. Topics include various metallurgical phenomena which, if disregarded, can lead to cracking, porosity, or welds with poor properties.

The Science of Nondestructive Testing  Approx. 6 hrs. / 6 PDHs  $235 / $175
The process and science behind five of the most common nondestructive tests used in the welding industry: visual testing, penetrant testing, magnetic particle testing, radiographic testing, and ultrasonic testing. This course is perfect for students and welding professionals involved in inspection, supervision, and quality control.

Destructive Testing  Approx. 7 hrs. / 7 PDHs  $400 / $300
This engaging online course describes the material properties of metals that can be evaluated with destructive testing, as well as the principles and performance of the most common destructive tests used in the welding industry.

Economics of Welding  Approx. 18 hrs. / 18 PDHs  $600 / $450
Participants learn to identify, measure, and manage the costs of production in order to reduce costs and ensure quality. Topics include welding process variables, comparing welding processes, calculating weld metal volume and deposition rates, and managing the costs of labor, materials, equipment, and overhead.

WPS/PQR Explained  Approx. 4 hrs. / 4 PDHs  $150 / $120
The characteristics and use of Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) in an engaging multimedia format. Topics include essential and nonessential variables for arc welding, oxyfuel welding, resistance welding, and brazing procedure specifications; the procedure qualification process; and common nondestructive and destructive tests.

Lesser price shown is for AWS members.
Always get the best price from the source: 1-888-WELDING (935-3464) Option 1
AWS Online Code Clinics offer a detailed road map through some of the most commonly used codebooks in the welding industry. Participants will learn to quickly identify, locate, and use important clauses, tables, and figures in time-sensitive testing and working environments. Each code clinic also includes an exclusive online pre-course designed to help participants develop successful test-taking strategies based on the actual structure of the code book exam.

**D1.1 Online Code Clinic**  
Approx. 4 hrs. / 4 PDHs.  
$300 / $250  
This comprehensive, 4-hour course features easy-to-understand explanations as well as interactive questions and quizzes designed to help participants efficiently navigate the AWS D1.1 Structural Welding Code in the field or during the code book portion of the CWI exam.

**API 1104 Online Code Clinic**  
Approx. 3 hrs. / 3 PDHs.  
$300 / $250  
This self-paced course is designed to help participants working in the field or preparing for an AWS code book exam to quickly identify, locate, and use important clauses, tables, and figures in API 1104 Welding of Pipelines and Related Facilities.

**D17.1 Online Code Clinic**  
Approx. 4 hrs. / 4 PDHs  
$150 / $120  
This detailed road map of the D17.1 code employs easy-to-understand language, audio narration, and guided questions. Participants will learn to quickly locate important clauses, charts, and tables in time sensitive testing or working environments.

To see a live demo or to register for our online programs visit [awo.aws.org](http://awo.aws.org)
Industrial Metallurgists, LLC
This series of courses is ideal for design, manufacturing, and quality engineers who need to better understand metallurgical concepts in order to help clients improve productivity and profitability. Courses include Principles of Metallurgy, Aluminum Metallurgy, Steel Metallurgy, and Tensile Testing.

Aluminum Metallurgy  Approx. 1 hr.  $85
There are a wide variety of wrought aluminum alloys. Each alloy was developed to provide specific properties. This course teaches the following aspects of aluminum metallurgy:
- The different families of wrought aluminum alloys
- The distinguishing features between the families
- The metallurgical factors that influence their mechanical properties
- How the mechanical properties are modified using alloy composition, cold-working, and heat treatment
- The temper designation systems for cold-worked and heat treated alloys

Principles of Metallurgy  Approx. 5 hrs.  $225
This course teaches 3 key principles about metallurgy:
1. The microscopic structures present in metals.
3. How composition, cold-working, and heat treating are used to modify metal microstructure to obtain desired mechanical properties.
Having a good understanding of how metals behave and what can be done to modify a metal’s properties is critical for being more productive and profitable. This knowledge enables people to make better design and manufacturing decisions, solve quality problems, and have productive conversations with suppliers, customers, and engineers.

Hardness Testing  Approx. 1/2 hr.  $39
This course teaches about Rockwell and Brinell hardness testing and Vickers and Knoop microhardness testing. You will learn how tests are performed, test sample and testing requirements, and test parameter selection.

Steel Metallurgy  Approx. 3 hrs.  $180
Understanding steel metallurgy involves understanding the effects of alloy composition and steel heat treating processes on the microstructure and properties of steel is critical for:
- Selecting the most appropriate alloy and heat treating process for your application
- Evaluating suppliers
- Developing manufacturing processes
- Solving quality problems

Steel Case Hardening  Approx. 1 hr.  $70
If your products use case hardened steel components, understanding the effects of alloy composition and heat treating process conditions on the microstructure and properties of the steel is critical for:
- Selecting the most appropriate alloy and heat treating process for your application.
- Evaluating suppliers
- Developing manufacturing processes
- Solving quality problems
Steel Through Hardening  Approx. 1 hr.  $70
If your products use through hardened steel components, understanding the effects of alloy composition and heat treating process conditions on the microstructure and properties of the steel is critical for:
- Selecting the most appropriate alloy and heat treating process for your application.
- Evaluating suppliers
- Developing manufacturing processes
- Solving quality problems

Tensile Testing  Approx. 1/2 hr.  $39
This course teaches about tensile testing of metals. You’ll learn how tests are performed, test sample and testing requirements, and how tensile properties are determined from the test data.

NDT Classroom
NDT Classroom recognizes the need for effective online NDT training. NDT legends Chuck Hellier and Jim Treat have brought together industry leading instructors. Together they offer completely video-based online NDT training to create NDT Classroom.

Introduction to NDT  Approx. 5 hrs.  $525
The Introduction to NDT course is ideal for those who would like a thorough overview of the major methods. Emphasis is placed on benefits, limitations, and applications and is a four-hour modularized program with quizzes after each module and a final course examination. Methods covered include Visual Testing (VT), Penetrant Testing (PT), Magnetic Particle Testing (MT), Radiographic Testing, (RT), Ultrasonic Testing (UT) and Eddy Current Testing (ET).

Eddy Current I  Approx. 20 hrs.  $1045
The Eddy Current Level I course covers the basic principles and fundamentals of Eddy Current Testing. It covers the theory and techniques essential for those seeking certification as ET Level I. The course is approximately 20 hours in duration and includes equipment calibration and use, selection of probes/coils, and focuses heavily on general surface techniques for a variety of industrial and aerospace applications. It also covers metal sorting procedures and a variety of other uses.

Eddy Current II  Approx. 20 hrs.  $1045
The Level II course provides additional reinforcement and expansion on the basic principles and fundamentals of eddy current testing that were covered in the Level I course. It covers the variables such as test frequency/and unique techniques for advanced applications and emphasizes the evaluation and interpretation of eddy current test results and includes reporting. Duration is approximately 20 hours.

Visual Testing I & II  Approx. 12 hrs.  $725
Because Visual Testing is the oldest and most widely used nondestructive test method, this online course is ideal for individuals beginning their career in inspection or nondestructive testing. This course combines Level I and II subjects and runs approximately 12 hours in length It is highly recommended as a prerequisite for those planning to specialize in other NDT methods, or for personnel who are planning to become certified in visual testing. It covers fundamentals, equipment, techniques, procedures and evaluation criteria for a variety of applications including welds.
Penetrant Testing I & II  
**Approx. 14.5 hrs.**  
$835

Penetrant Testing is a widely used NDT method for the detection of very small discontinuities that are open to the surface in most metals and other solid nonporous materials. It is capable of detecting flaws well below the threshold of visual testing. This combined Level I and II course, which runs approximately 12.5 hours, both visual and fluorescent penetrants are discussed. PT materials, equipment, variables, techniques, and evaluation of test results are presented and demonstrated along with a description of widely used applications.

Magnetic Particle Testing I & II  
**Approx. 11 hrs.**  
$835

This course combines the Level I and II subjects lasting approximately 11 hours, and includes the principles of magnetism, test techniques and procedures as applied to the detection of flaws in ferromagnetic materials. Other subjects covered include variables, direct and indirect magnetization, equipment and accessories, precautions, and demagnetization. It is a quick and effective test for the detection and evaluation of discontinuities at or very close to the surface of the object being examined.

Radiography Testing I  
**Approx. 22 hrs.**  
$725

This course provides the student with the theory and principles of radiation and how they relate to the basics of radiographic testing. It is the first step for those who will be seeking a career as a radiographer. It covers the basic steps in producing an acceptable radiograph including the control of variables such as energy, exposure times, selection of film or imaging devices, and processing. This course runs approximately 22 hours and emphasizes the essentials of radiation safety. It is also appropriate for other personnel who require a basic understanding of the basics of radiographic testing.

Radiography Testing II  
**Approx. 22 hrs.**  
$945

Radiography Testing Level II is a continuation of the Level I course and expands on the variables and how to control them in order to produce a high-quality image. It takes approximately 24 hours and includes the use of both x-ray and gamma-ray sources and conventional radiographic techniques using film. It also describes the benefits of computed and digital (CR/DR) techniques. Emphasis is placed on the evaluation and interpretation of radiographic images and the need for complete and concise reporting. It is an essential course that covers the advanced theory and principles necessary for those seeking to become Level II radiography technicians.

Radiation Safety Course  
**Approx. 28 hrs.**  
$1045

The Radiation Safety course provides an understanding of the basic principles and fundamentals of radiation safety applicable to industrial radiography. It addresses the 40-hour training prerequisite and the required training topics for radiographic personnel as required by federal (10 CFR 34.43) and equivalent state radiation control regulations. This online is 28 hours and upon completion, the individual’s RSO should provide the remaining 12 hours of site-specific training if certification is to be achieved. Learning outcomes are assessed using written quizzes at the end of each lesson and through a comprehensive final exam.
Ultrasonic Testing I  Approx. 26 hrs.  $835
This course includes a basic introduction to the theory and principles of ultrasonic testing including frequency, velocity, and wavelength as well as wave modes. This course is essential for those desiring to enter and specialize in ultrasonic testing and takes approximately 28 hours to complete. It also covers materials considerations, calibration, equipment, selection of proper transducers, techniques, test procedures and applications. It is also beneficial for those who will not be practitioners but who want to understand the basic principles and applications of ultrasonic testing.

Ultrasonic Testing II  Approx. 26 hrs.  $945
Ultrasonic Testing is an extension of the Level I course and expands on the theory and principles to a much greater depth. A wider range of applications and applicable techniques are covered. Emphasis is placed on the evaluation of discontinuities and test requirements. The inspection of various types of welds are covered in detail. This is an essential course for those practitioners who will be pursuing a career in ultrasonic testing and for those striving for certification as a Level II. The course takes approximately 22 hours to complete and will also be beneficial for those preparing to take Level III examinations.

Ultrasonic Thickness Testing  Approx. 14 hrs.  $725
This course describes the basic principles of ultrasonic testing as they apply to thickness testing of materials and components and is ideal for those individuals who will be taking thickness measurements and/or are pursuing Limited Level II ultrasonic testing thickness certification. It covers the compressional wave technique, thickness testing equipment operation, transducers, and variables. Recording options are also discussed in the course that requires approximately 14 hours to complete.

Visit awo.aws.org for more information
Individual Membership
Annual dues: $88
Strengthen your professional career with member-only knowledge and tools, including leading welding industry publications and news; access to certification resources, educational programs and networking opportunities; exclusive discounts on home and auto insurance; and more.

Welder Membership
Annual dues: $88
Take advantage of specialized membership benefits geared towards welders. Gain access to courses, seminars, certifications and other resources; gain exclusive discounts on home and auto insurance; discounts on tools and equipment; and more from the industry’s leading welding organization.

Corporate Membership
Strengthen your business impact and employees’ expertise by joining the world’s leading welding organization. There are five different types of corporate programs: Sustaining Company, Supporting Company, Affiliate Company, Educational Institute, and Welding Distributor.

Sustaining Company
Annual dues: $880 (domestic), $980 (international)
Designed for those who seek top industry impact. You get a choice between two primary benefits valued at up to $12,000; 10 individual memberships; powerful marketing exposure; plus dozens more resources and benefits.

Supporting Company
Annual dues: $440
Designed to help your mid-size company boost productivity, solve production problems; improve competitiveness and offer valuable benefits to your employees.

Affiliate Company
Annual dues: $200
Designed specifically for your independent shop. AWS keeps your team informed on industry changes and developments; recommends ways to increase productivity and solve problems; and helps you stand out from the competition.

Educational Institute
Annual dues: $264
Designed for educational leaders who strive to maintain a reputation for teaching excellence. Your membership supports and rewards hard-working educators, staffs and students with valuable benefits and savings.

Welding Distributor
Annual dues: $545
Designed to provide you with valuable industry exposure and connections to increase your sales and market share.

Student Membership
Annual dues: $15
Build a stronger welding career with top knowledge, advice and industry contacts – plus dozens of money-saving programs and benefits. Your membership shows employers and fellow professionals you’re serious about your future. Don’t miss our deeply-discounted rate just for students.
AWS MEMBERSHIP APPLICATION

Join or Renew: [ ] Mail: Form with your payment, to AWS [ ] Call: Membership Department at (800) 443-9353, ext. 480 [ ] Fax: Completed form to (305) 443-5647 [ ] Online: www.aws.org/membership

CONTACT INFORMATION

First Name: ___________________________ M.: ___________________________ Last Name: ___________________________

Birthday: ___________________________ Secondary Phone (__-__-____) ___________________________

Cell Phone (___-__-____) ___________________________

Address: ________________________________________________________________________________

City: ___________________________ State/Province: ___________________________

Zip/PostalCode: ___________________________

Who pays your dues?: [ ] Company [ ] Self-paid [ ] Sr. [ ] Male [ ] Female

Education level: [ ] High school diploma [ ] Associate’s [ ] Bachelor’s [ ] Master’s [ ] Doctoral

Technical Interests (Check all that apply)

B. [ ] Buyer [ ] Purchasing [ ] Engineer — design [ ] Technician [ ] Draftsman
C. [ ] Lecturer [ ] Educator [ ] Engineer — welding [ ] Superintendent, foreman [ ] Engineer — other [ ] Inspector, tester
D. [ ] Manager, director, superintendent (or assistant) [ ] Purchasing [ ] Engineer — welding [ ] Technician
E. [ ] Editor [ ] Librarian [ ] Engineer — other [ ] Supervisor, foreman [ ] Engineer — manufacturing
F. [ ] Editor [ ] Librarian [ ] Engineer — welding [ ] Technician
G. [ ] Editor [ ] Librarian [ ] Engineer — welding [ ] Technician
H. [ ] Manager, director, superintendent (or assistant) [ ] Purchasing [ ] Engineer — welding [ ] Technician
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Inspection

B1.10M/B1.10:2016, Guide for the Nondestructive Examination of Welds
This guide acquaints the user with the nondestructive examination methods commonly used to examine weldments. The standard also addresses which method best detects various types of discontinuities. The methods included are visual, liquid penetrant, magnetic particle, radiographic, ultrasonic, electromagnetic (eddy current), and leak testing. 72 pages, 4 tables, 5 annexes, 33 figures, fifth edition.
Order Code: B1.10

B1.11M/B1.11:2015, Guide for the Visual Examination of Welds
Provides guidance on visual examination of welds, including sections on prerequisites, fundamentals, surface conditions, and equipment. Sketches and color photographs illustrate common weld discontinuities. 62 pages, 1 table, 4 annexes, 58 figures.
Order Code: B1.11

B4.0:2016, Standard Methods for Mechanical Testing of Welds
Mechanical test methods that are applicable to welds and welded joints are described. For each testing method, information is provided concerning applicable American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and American Petroleum Institute (API) documents; the required testing apparatus, specimen preparation, procedure to be followed, and report requirements are also described. 168 pages, 97 figures.
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B4.0M:2000 (R2010)
Metric only. 120 pages, 64 figures (Reaffirmed 2010).
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WI:2015, Welding Inspection Handbook
This invaluable training reference helps inspectors, engineers, and welders evaluate the difference between discontinuities and rejectable defects. 289 pages 18 chapters, index, 108 figures, 16 tables, 6-1/2” x 9”, fourth edition.
Order Code: WI

C2.21M/C2.21:2015, Specification for Thermal Spray Acceptance Inspection see page 62

C3.2M/C3.2:2008, Standard Method for Evaluating the Strength of Brazed Joints see page 54

G1.2M/G1.2:1999 (R2010), Specification for Standardized Ultrasonic Welding Test Specimen for Thermoplastics see page 74

G1.10M:2016, Guide for the Evaluation of Thermoplastic Welds see page 74
AWS PGVE – *AWS Pocket Guide for Visual Examination of Welds - Discontinuity Causes and Remedies*

This guide features an emphasis on the detection and repair of physical weld discontinuities found in common arc welding processes. The pocket guide is an excellent field tool for welders, welding inspectors and CWI's, and can serve as an integral part of a Welding Inspection (WI) training program. 38 pages

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- Flux Cored Arc Welding
- Electrogas Welding
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Includes requirements for qualification of Welding Procedure Specifications, welders, and welding operators for manual, semi-automatic, mechanized, and automatic welding. Covers electrofusion, hot gas, socket fusion, butt contact fusion, infrared, extrusion welding, and flow fusion welding processes, as well as base materials, filler materials, qualification variables, and testing requirements. Adopted by NBIC. 54 pages, 21 figures, 12 tables.

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B5.1:2013-AMD1, *Specification for the Qualification of Welding Inspectors*

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Provides the framework for an in-house certification program and written practice for welding inspectors. This specification for the qualification of welding inspector specialists and welding inspector assistants was developed to provide a qualification basis which defines minimum requirements for a welding inspector specialist to demonstrate competence through a combination of education, experience, and examination. 28 pages

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Establishes requirements for qualification of resistance welding technicians. Defines minimum experience, examination, application, qualification, and requalification requirements and methods. Provides a method for technicians to establish a record of their qualification and abilities, such as development of machine troubleshooting, processes controls, quality standards, and problem solving. 22 pages, 1 table, 2 annexes.
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This guide contains recommendations for establishing a thermal spray operator qualification program. Information related to training, knowledge and skill testing, and coating system inspection methods is provided. Example thermal spray operator qualification tests (TSOQT) parameters and forms are provided, to address common engineering and corrosion control applications using arc, flame, atmospheric plasma, and high velocity oxygen fuel (HVOF) spray processes. 46 pages.
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This specification on laser beam welding discusses applicable specifications, safety, requirements, fabrication, quality examination, equipment calibration and maintenance, approval of work, and delivery of work. 52 pages.
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Provides processing and quality control requirements for Laser Hybrid Processing. Equipment includes any laser source (examples include, but are not exclusive to CO2, Nd: YAG, Diode, Ruby, Yb Fiber (Fibre), Yb Disk (Disc), Nd: Glass) in combination with an arc welding system (power supply, wire feeder, torch, etc.) as defined by AWS A3.0M/A3.0, Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying. 50 pages.
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Provides requirements for the qualification of robotic arc welding support personnel at three different levels: CRAW-L1, CRAW-O, and CRAW-T. The revisions in this edition align education and experience requirements more realistically with those in industry. This standard is the basis for the AWS Certification of Robotic Arc Welding Personnel (CRAW) program. (See AWS QC19:2002 on page 14.) 22 pages, 2 annexes, 3 figures, 4 tables.
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EG2.0:2017, *Guide for the Training of Welding Personnel; SENSE Level I-Entry Welders*
This guide contains information to assist education and training organizations in the development and administration of a modular, competency-based training that leads to the qualification of a trainee in accordance with the requirements of AWS QC10, Specification for Qualification and Certification of SENSE Level I-Entry Welders.
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The goal of this supplement is to improve welder training by using and teaching the application of AWS SWPSs related to the SENSE Level I-Entry Welder workmanship and performance qualification tests. It provides Workmanship and Welder Performance Qualification Technique Sheets and accompanying SWPSs for each SENSE Level 1 workmanship and welder performance qualification test for production welding.
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CM:2000, Certification Manual for Welding Inspectors
The best-selling reference used by thousands of CWI examination candidates since 1977. Chapters cover the welding inspector’s responsibilities; standards; joint geometry and terminology; symbols; weldability; destructive testing; procedure and welder qualification; welding, brazing, and cutting processes; discontinuities; nondestructive examination; and inspector reports. Each chapter concludes with a self-administered test similar in content and style to the actual CWI exam questions. Features a contemporary layout that includes tip boxes. This book has been invaluable to literally thousands of CWI applicants who studied on their own for the AWS CWI exam. 314 pages, 11 chapters, 152 figures, 23 drawings, 8 tables.
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Self-study guide for the AWS Certified Welding Supervisor certification exam. Will appeal to everyone concerned with enhancing productivity in the welding workplace. Reviews management systems for welding supervisors, requirements of welds, detailed descriptions of four welding processes (SMAW, GMAW, FCAW, and SAW), welding metallurgy, welding symbols, welding instructions, welding economics, the application of welding standards, welding inspection, health and safety, and work reports and records. The welding economics chapter will help the welding supervisor estimate and control costs for welding jobs. Includes practice questions and additional references. 400 pages, 14 chapters.
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- Hi-Lo Gauge
- Protractor
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- Weld Profile Gauge

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WIT-T:2008, Welding Inspection Technology
For at-home study, this official reference textbook for the two-day AWS core seminar for CWI exam preparation is readable, informative, and comprehensive. 329 pages, 10 chapters, 379 figures and photographs.
Order Code: WIT-T $296 / $222

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Course designed to provide a basic foundation of knowledge for the Radiographic Interpreter (RI) and to prepare them for the American Welding Society’s Radiographic Interpreter Certification Examinations in accordance with AWS B5.15, Specification for Qualification of Radiographic Interpreters.
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- **Date:** June 16-18, 2020
- **Location:** Toronto Congress Centre | Toronto, Canada

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Your Source of Welding and Metallurgy Technology Content

The AWS Digital Library unlocks the world of metallurgy, welding process technology, and related engineering and manufacturing sciences for academia. Our platform gives access to unique content from the American Welding Society which has not been readily available before, to include standards, reference materials, periodicals and instructional videos. Additionally, the AWS Digital Library includes a wide range of journals from across the Internet which have been indexed and made discoverable in the platform.

Users will experience an intuitive, easy-to-use interface which provides multiple pathways to search, discover, and retrieve relevant content, supplementing and enhancing instructional plans, coursework and studies.

The AWS Digital Library delivers a wealth of content to academia and the subscription pricing is developed with academic budgets in mind.

**BENEFITS**

**Unique Content:**
- **Standards:** AWS is the sole producer of its welding standards which are the national standards in the USA (ANSI accredited).
- **Reference Books:** Our books include the AWS Welding Handbook series, Welding Metallurgy, Brazing Handbook, as well as others.
- **Periodicals:** Welding Journal, Inspection Trends, and Spraytime are AWS periodicals which have long been member benefits without wide public distribution. Now these periodicals and their archives are delivered through the AWS Digital Library.
- **Added Journal Content:** Indexed journals across all disciplines from the WWW. Generally hard to find titles that contain important discoveries and prior art and now accessible through the periodicals package.
- **Videos:** Instructional videos which give insights into fundamentals, processes, and health and safety considerations of welding and metallurgy.

**Intuitive and User-Friendly Platform:**
- Users can search for relevant information using key word search options, or they can discover new concepts and relationships using the discovery tool. Answer sets can be further refined to hone down the results to essential results.
- A glossary of key words is available for users to take advantage of – developed from the AWS standard A3.0, the authoritative source of welding terms and definitions.
- Multiple search refinement options give users different ways to find content important to their work. These include authors, publication year, type of publication, and titles.

**Affordably Priced:**
- The AWS Digital Library is a 12-month subscription model with pricing based on the size of the academic institution.
- An institution can tailor the subscription to meet its needs by being able to pick and choose among the four content packages (standards, references, periodicals, videos). Volume discounts are built in as more of the packages are subscribed to.
- No additional fees for access to archives of the AWS periodicals.
- Subscriptions can be started at the beginning of any month, comporting to the schedule and budget cycle of the academic institution.
### 12-Month Subscription Pricing

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<th>3 Content Packages</th>
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<td>$1,700</td>
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Any additional campus locations will cost an additional 10% per location off the non-discounted list price. A campus is defined as a location within a city.

### Other Special Pricing Situations:

- **Online Only Schools**
  Where there are no physical campuses, only a virtual presence.
  - $12,000

- **Consortia or State Systems**
  Group purchases for multiple entities by an legally authorized body.
  - Handled on a case-by-case basis

### BY THE NUMBERS:

- **Standards Package**: Contains all the AWS welding standards, procedures, qualifications, and recommended practices — over 160 documents updated with the most current editions of each valued at over $20,000.

- **Reference Package**: Includes the AWS Welding Handbook series, a must-have reference set for engineers, structural designers, technologists, inspectors, welders, welding educators, and others who need to understand this dynamic industry. Other critical reference books include the Brazing Handbook, Welding Metallurgy, and more valued at over $2,000.

- **Periodicals Package**: Contains a century of the Welding Journal — from current edition all the way back to volume 1, issue 1 in 1919. Additionally, renown publications Inspection Trends and Spraytime magazine comprise the package. AWS has also indexed thousands of open access journals from across the internet to ensure the latest developments in engineering technology are discoverable. This package is valued at over $14,000.

- **Video Package**: Contains 13 synopses of important process, safety, and fundamentals and theory of welding, metallurgy and related topics. These videos are important precursors to the AWS Online Educational Library valued at $9,000.

---

**Interested in Subscribing?**

Contact 1-800-443-9353 Ext 333 or submit an e-mail to: eabrams@aws.org.

For additional information and to create a free trial account to review the Library’s features please refer to the following link: [AWSL.madcad.com](http://AWSL.madcad.com).
The AWS Online Educational Library is designed to meet the needs of today’s welding students and instructors. Built by AWS subject matter experts and learning professionals, AWS online courses feature engaging multimedia content that stimulates learning and long-term retention.

Brief modules, learner-centered navigation, and 24/7 access allow time-strapped students to learn at their own pace from any laptop, phone, or tablet. Equally busy instructors can use the AWS Learning Management System to assign tasks and track student progress.

The AWS Online Educational Library includes the following courses:

- Destructive Testing
- Economics of Welding
- Fabrication Math I
- Fabrication Math II
- Metallurgy I
- Metallurgy II
- Nondestructive Testing
- Welding Fundamentals I
- Welding Fundamentals II
- Welding Fundamentals III
- Welding Safety
- Welding Symbols
- WPS/PQR Explained

The AWS Online Educational Library is affordably priced to fit the budgets of both corporate and academic institutions. Visit awo.aws.org to learn more about each course, and contact us today to receive a personal online demonstration of all the features that the AWS Learning Management System has to offer.
The AWS Online Educational Library is designed to meet the needs of today’s welding students and instructors.

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Learning Management System allows instructors to view tests and quizzes, and track student progress.

Module Quizzes allow students to measure content retention and comprehension.

Short Modules allow students to digest information in manageable chunks, and allow instructors more flexibility in the assignment of material.

Interactive Elements at key junctures throughout each module provide students with ample opportunity to master concepts and formulas.

Audio Narration as well as animated graphics, and video footage make even the most complex topics both engaging and easy to understand.

Learning Objectives and quizzes allow students to orient themselves and assess their readiness to tackle new material.

Navigation Features allow students to skip or review course content as needed, giving the student complete control over their learning experience.

12-month Subscription Pricing

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Open-Enrollment Pricing

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<td>Minimum spending commitment</td>
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AWS SENSE for Educational Organizations
The AWS Schools Excelling through National Skill Standards Education (SENSE) program began in 1993 with the award of a grant by the U.S. Department of Education to develop a series of voluntary standards to promote consistency and quality in welding education on a national basis. Currently, there are two levels of SENSE: Level I—Entry Welder and Level II—Advanced Welder. Both levels are designed to facilitate the implementation of a modular welder training program based on best practices. The program is governed by a set of standards: QC10, EG2.0, and EG2.0 Supplement for Level I – Entry Welder and QC11, EG3.0, and EG3.0 Supplement for Level II.

One-time registration fee for Level I $500
One-time registration fees for Levels I and II combined $600
One-time upgrade registration fee from Level I to Level II $100

AWS SENSE for Students
A student who graduates from a program which meets the SENSE requirements is eligible for a SENSE completion certificate from AWS. An AWS SENSE Entry Welder is an individual who has achieved full or partial completion status by successfully completing compulsory and optional modules in accordance with the requirements of SENSE Level I—Entry Welder. An AWS SENSE Advanced Welder is an individual who has achieved full or partial completion status by successfully completing compulsory and optional modules in accordance with the requirements of SENSE Level I—Entry Welder and AWS SENSE Level II—Advanced Welder. AWS SENSE Entry Welder and Advanced Welder should not be confused with AWS Certified Welder.

Administrative Fee (per student, per level) $20

Scholarships available through the AWS Foundation
In 2019, the AWS Foundation has over $1.3 million dollars in scholarships available for students pursuing education and training in welding and related fields.

The AWS Foundation offers various types of scholarships at the National, District, and Section level for four-year, two-year, and certificate programs.

For more information on all scholarship programs, please visit aws.org/scholarships
AWS can now deliver ISO Welding Standards

Standards published under ISO/TC 44, “Welding and allied processes and ISO/TC 167, Steel and aluminum structures,” are available in the AWS bookstore at member and nonmember pricing under the following categories:

- Aluminum Structures
- Brazing Materials and Processes
- Equipment for Gas Welding, Cutting and Allied Processes
- Execution of Steel Structures
- Safety and Health
- Personnel Qualification Requirements
- Quality Requirements Including Welding Procedure Specifications
- Representation and Terms
- Resistance Welding and Allied Mechanical Joining
- Soldering Materials
- Steel: Fabrication and Erection
- Steel: Material and Design
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This metric practice guide is based on the International System of Units (SI) as defined in the U.S. Federal Register notice of July 28, 1998, “Metric System of Measurement: Interpretation of the International System of Units for the United States.” It includes the base units, derived units, and rules for their use. Also covered are conversion factors and rules for their use in converting U.S. customary units to SI units. 58 pages.
Order Code: A1.1
Spanish Edition (2001) $80 / $60

A2.1, *Welding Symbol Charts*
Easy-to-read laminated desk and wall charts to complement AWS A2.4:2012, Standard Symbols for Welding, Brazing, and Nondestructive Examination. For desktop, drafting table, shop, or classroom use.
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- Desk Chart (11” x 17”) Order Code: A2.1-DC $36 / $27
- Buy Both Charts, SAVE 10% Order Code: A2.1 WC & DC $72 / $54
- Buy the Complete Set, SAVE 15%
  - A2.4:2012 (Book) and A2.1:2012-WC & DC (Charts) Order Code: A2.4/A2.1 SET $216 / $162
  - Larger Wall Chart (36” x 27”) Order Code: A2.1-WCXL $48 / $36

A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*
Establishes a method of specifying certain welding, brazing, and nondestructive examination information by means of symbols. Contains detailed information and examples for the construction and interpretation of these symbols. This system provides a means of specifying welding or brazing operations and nondestructive examination, as well as the examination method, frequency, and extent. 150 pages.
Order Code: A2.4

A3.0M/A3.0:2010, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*
Alphabetical glossary of over 1,400 standard terms and definitions for welding, brazing, soldering, resistance welding, etc., as well as hybrid processes. Each term has one clearly applicable definition, accurately reflecting the term’s use in the joining world. Includes figures to illustrate the use of terms. For completeness, nonstandard terms are also included. Contains a Master Chart of Welding and Allied Processes, and the Joining Method Chart. 160 pages, 62 figures, 5 tables.
Order Code: A3.0

A3.1:2010, *Master Chart of Welding and Joining Processes*
24” by 30” chart extracted from A3.0 Order Code: A3.1 $44 / $33

Jefferson’s Welding Encyclopedia
A handy reference for anyone who needs quick access to welding information. Topics are explained, illustrated, and made comprehensible. Includes a historical look at the welding industry. 768 pages, CD-ROM or 8” x 10” best copy available, 18th edition.
Order Code (Book): JWE $180 / $135
Order Code (CD-ROM): JWE CD $180 / $135
Welding Metallurgy, Carbon and Alloy Steels, Volume 1, Fundamentals
Written by the late George E. Linnert, one of America's most respected and informed metallurgical authorities. Builders, manufacturers, welding shops, colleges, and universities will benefit from this indispensable reference book. Best copy available, 964 pages, 10 appendices, 248 figures, 62 tables, 7” x 10”, fourth edition.
Order Code: WM1.4 $152 / $114

Total Welding Management
Systematic approach to welding excellence and cost reduction. Drawing on 50 years of welding experience, author Jack R. Barckhoff, P.E. gives a step-by-step plan to maximize the productivity and cost efficiency of a welding operation. Explains the management principles, structure, and details needed to transform a welding operation from a cost center into a profit center. A must-read for supervisors, managers, and executives. 200 pages, 35 figures, 20 tables, 6” x 9”.
Order Code: TWM $49.50

The Industrial Hobarts
Peter C. Hobart, former vice president for international business at Hobart Brothers, tells the story of three generations of the Hobart family. 256 pages.
Order Code: TIH-H $40 / $30

Welding – A Journey to Explore Its Past
Welding – A Journey to Explore Its Past is for anyone interested in history or is involved in welding in some form or another including welders, welding inspectors, engineers, educators, students, as well as future welding students. This book strives to answer just a few questions about the origins of welding. Easy to read, it is not written as a text book or an academic paper. It aims to give the reader a basic knowledge of the history of welding, its problems, and its contributions to society. 213 pages; over 600 illustrations
Order Code: WJEP $29.95

Pipe Welding, 1st Edition
A comprehensive guide to pipe welding that will help you take your career potential to the next level. In the surging pipe welding job market, you need to not only know basic welding techniques, such as pipe layout and assembly, you also need to master welding techniques like SMAW, GMAW, FCAW, and GTAW processes. This textbook is the practical guide that can help you become a safe, effective, and marketable pipe welder.
Order Code: PWCEN $62

Welding Principles and Applications
This proven guide provides the knowledge and skills you need to complete AWS SENSE Level I and Level II programs, create Workmanship Qualification Specimens, and earn professional certification. Advancing rapidly from basic concepts and processes to today’s most complex, cutting-edge welding technologies and practices, this comprehensive text features valuable information on topics such as welding metallurgy, metal fabrication, weld testing and inspection, joint design, job costing, and environmental and conservation tips. The author opens each section by introducing you to the materials, equipment, setup procedures, and critical safety information you need to execute a specific process successfully, while subsequent chapters focus on individual welding tasks leading to SENSE certificate.
Order Code: WPACEN $102
Welder Log Book
The purpose of this log book is to serve as a tool for welding professionals to establish an independently verified log of welding processes to which they are qualified. The verifications (by a Certified Welding Inspector or an appointed person of the welder's employer) will establish the welder's compliance with period of effectiveness established in various welding codes.
Order Code: AWS WL

Welding Replica Set (RWK-A: REPLICA WELDING KIT)
The five-piece set is designed for training structural welding inspectors and welders. It is recommended for those preparing for the Practical (Hands-on) portion of the AWS Certified Welding Inspector examination. It is also excellent for other weld examination training programs requiring hands-on experience.
Order Code: RWK-A

Pelican Case for the Welding Replica Set
This case was customized to provide safe storage of the RWK-A replica set.
Order Code: Pelican Case

Welding Replica Set with Pelican Case
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Tenth Edition, Volume 1, *Welding and Cutting Science and Technology*

The new TENTH EDITION of the *Welding Handbook*, Volume 1 provides a solid background of the basic science and the latest technological developments in welding, cutting, and allied processes. The volume contains an overview of the most recent research and engineering developments, including codes and standards, certification, qualification, and more.

- 17 chapters cover all the fundamentals, including welding, cutting, joining, and allied processes; 4 chapters discuss metallurgy, physics, heat flow, residual stress and distortion; other important chapters discuss engineering, tooling and positioning, automation, and much more.

- Includes more than 700 drawings, schematics, and photographs, plus 170 tables for categorized or comparative information.

- Volunteer contributors include welding and metallurgy experts from many companies and institutions.

For more information, see page 51 in this Product Catalog or visit [aws.org/WeldingHandbook](http://aws.org/WeldingHandbook)
ANSI Z49.1:2012, Safety in Welding, Cutting, and Allied Processes

Addresses safe practices for performing welding, cutting, and allied processes in the welding environment, and addresses the mutual responsibilities for safety in welding by management, supervisors, educators, industrial hygienists, and welders. Suitable for issuance to the welder and shop management to give practical information to help them perform these functions safely. Specific provisions for oxyfuel gas and arc welding and cutting, resistance welding, electron beam welding, laser beam cutting and welding, and – new in this edition – brazing and soldering. Generally applicable to other welding processes such as submerged arc welding and allied processes. Contains information useful to educators, industrial hygienists, engineers, and other personnel responsible for safety and health in welding. Unions, societies, trade groups, and U.S. military and enforcement agencies – including AWS, Sheet Metal Workers, OSHA, and NIOSH – contributed in the development of this revision of Z49.1. 68 pages, 4 figures, 1 table, 11th edition.

Download FREE pdf at go.aws.org/weldsafe or purchase the printed document.
Order Code: Z49.1
$25


F1.1M:2018, Methods for Sampling Fumes and Gases Generated by Welding and Allied Processes

This document aids the reader in the proper technique for sampling welding fumes and gases in the workplace. Emphasis is placed on positioning the sampling device and calibration of the equipment. 38 pages.
Order Code: F1.1 $68 / $51

F1.2:2013, Laboratory Method for Measuring Fume Generation Rates and Total Fume Emission of Welding and Allied Processes

Outlines a laboratory method to determine fume generation rates and total fume emission, using a test chamber to collect representative fume samples under carefully controlled conditions. Allows use of alternative media if demonstrated to be equivalent to the glass fiber pad. 24 pages.
Order Code: F1.2 $64 / $48


Provides advice on contaminants that may be present in the welding environment, and presents a strategy for collecting valid samples from the welder’s breathing zone. Recommendations for fume analysis for various elements found in AWS filler metal specifications are presented in a table. 30 pages.
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Reference Materials Publications
Safety & Health

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This document assists companies in estimating emissions from welding processes for EPA reporting purposes by choosing the simplest applicable method and following its steps. Example calculations are included. 20 pages.
Order Code: F1.6 $64 / $48

F2.2:2001 (R2010), *Lens Shade Selector*
11” x 17” chart (Reaffirmed 2010).
Order Code: F2.2 $40 / $30

Reasonable and adequate methods for testing, selection, and use of transparent welding curtains and screens. Includes an annex on measurement of spectral transmittance. 24 pages, 3 tables.
Order Code: F2.3 $64 / $48

F3.2M/F3.2:2018, *Ventilation Guide for Weld Fume*
This document introduces the reader to various types of ventilation systems, including general supply and exhaust and local exhaust, for control of weld fumes. It contains or refers to information on air contaminants found in welding fumes, principles of system design and selection, and drawings that illustrate ventilation techniques. 42 pages.
Order Code: F3.2 $80 / $60

This standard informs the reader of the necessary safe practices to be followed in the cleaning and preparation of containers and piping for welding or cutting. It describes various methods for cleaning, including water, steam, hot chemical and mechanical, and techniques to be used for their proper preparation, such as inerting. 20 pages.
Order Code: F4.1 $64 / $48
Effects of Welding on Health
Reviews of worldwide medical literature on potential health effects of welding-related physical and chemical hazards. Each volume summarizes studies of occupational exposures, information on the human health effects of welding, and the effects of welding on experimental animals and cell cultures over a particular time period. Offers industrial hygienists and safety and medical professionals the necessary background and knowledge to deploy effective protective devices and engineering controls, and to respond to unique exposure situations. Compiled for the AWS Safety and Health Committee.

Download FREE pdf at go.aws.org/weldhealth or purchase the printed document.

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<th># Pages</th>
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Price (each) $52 / $39
Fumes and Gases in the Welding Environment
Summarizes five experimental studies and several literature surveys (conducted by Battelle Memorial Institute-Columbus Laboratories for the American Welding Society) to evaluate the extent to which ventilation may control the exposure of the welder to these fumes and gases and to investigate the nature of the various fumes and gases generated in arc welding, in brazing with silver-based filler metals, in thermal spraying, and in oxyfuel gas cutting. 244 pages, 82 figures, 99 tables.
Order Code: FUMES AND GASES
$144 / $108

Welding Zinc-Coated Steels
Results of a four-year work program from 1972 sponsored by the International Lead Zinc Research Organization, provides procedures and safe practices. 131 pages.
Order Code: WZC
$116 / $87

C4.2/C4.2M:2017, Recommended Practices for Oxyfuel Gas Cutting
Torch Operation see page 64

Torch Operation see page 64

Safety in Welding
Comprehensive overview of welding hazards, safety equipment, ventilation, welding in confined spaces, and safety precautions and specifications in an accessible and engaging format. see page 13

Lesser price shown is for AWS members.
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### Sheet Metal

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<th>Process</th>
<th>Filler Metal</th>
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<td>ER70S-6</td>
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<td>B2.1-1-007:2002(R2013)</td>
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<tr>
<td>Galvanized Steel</td>
<td>10-18 gauge</td>
<td>SMAW</td>
<td>E6010 or E6013</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-1-011:2002(R2013)</td>
</tr>
<tr>
<td>Carbon to Stainless</td>
<td>10-18 gauge</td>
<td>GMAW-S</td>
<td>ER309</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-1-8-006:2002(R2013)</td>
</tr>
<tr>
<td>Carbon to Stainless</td>
<td>10-18 gauge</td>
<td>GTAW</td>
<td>ER309</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-1-8-010:2015</td>
</tr>
<tr>
<td>Carbon to Stainless</td>
<td>10-18 gauge</td>
<td>SMAW</td>
<td>E3XX-15,-16 or -17</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-1-8-014:2002(R2013)</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>10-18 gauge</td>
<td>GMAW-S</td>
<td>ER3XX</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-8-005:2002(R2013)</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>10-18 gauge</td>
<td>GTAW</td>
<td>ER3XX</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-8-009:2002(R2013)</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>10-18 gauge</td>
<td>SMAW</td>
<td>E3XX-15,-16 or -17</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-8-013:2002(R2013)</td>
</tr>
<tr>
<td>Aluminum</td>
<td>10-18 gauge</td>
<td>GTAW</td>
<td>ER4043 or R4043</td>
<td>As-welded, with w/o backing</td>
<td>B2.1-22-015:2011</td>
</tr>
</tbody>
</table>

### Plate (All standards below are adopted by National Board Inspection Code)

<table>
<thead>
<tr>
<th>Base Metal</th>
<th>Thickness</th>
<th>Process</th>
<th>Filler Metal</th>
<th>Condition</th>
<th>Order Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Steel</td>
<td>1/8&quot; – 1/2&quot;</td>
<td>GTAW</td>
<td>ER70S-2 or E7018</td>
<td>As-welded or PWHT</td>
<td>B2.1-1-001:1990(R2006)</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>1/16&quot; – 1/12&quot;</td>
<td>GTAW</td>
<td>ER3XX, E3XX-XX</td>
<td>As-welded</td>
<td>B2.1-8-024:2001(R2012)</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>1/8&quot; – 1/2&quot;</td>
<td>FCAW, self-shielded</td>
<td>E71T-11</td>
<td>As-welded</td>
<td>B2.1-1-027:2018</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>1/8&quot; – 1/2&quot;</td>
<td>FCAW-G, CO₂ gas shielded</td>
<td>E707T-1 or E71T-1</td>
<td>As-welded or PWHT</td>
<td>B2.1-1-019:2018</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>1/8&quot; – 1/2&quot;</td>
<td>FCAW-G, CO₂ gas shielded</td>
<td>E707T-1 or E71T-1</td>
<td>As-welded or PWHT</td>
<td>B2.1-1-020:2018</td>
</tr>
</tbody>
</table>

*Downhill progression on root pass. All other vertical position passes are up hill.*
### Primarily Pipe

(All standards below are adopted by National Board Inspection Code, except B2.1-202)

| Carbon Steel | 1/8" – 1-1/2" | GM/AW-5 to FC/AW-0** | ER70S-3 & E70T-1M, E71T-1M or -12M | As-welded or PWHT | B2.1-1-223:2006
|---------------|----------------|----------------------|-------------------------------------|-------------------|--------------------------
| Carbon Steel | 1/8" – 1-1/2" | GM/AW-6 to FC/AW-0** | ER70S-3 | As-welded or PWHT | B2.1-1-233:2006
| Carbon Steel | 1/8" – 1-1/2" | FC/AW-6, A-CO2 shielded | E70T-1M, E71T-1M, or E71T-12M | As-welded or PWHT | B2.1-1-234:2006
| Carbon Steel | 1/8" – 1-1/2" | GM/AW spray transfer** | E70S-3 | As-welded or PWHT | B2.1-1-235:2006
| Carbon Steel | 1/8" – 1-1/2" | GTAW | ER70S-2 | As-welded or PWHT | B2.1-1-207:1996 (R2007)
| Carbon Steel | 1/8" – 1-1/2" | GTAW | ER70S-2 & E70T18 | As-welded or PWHT | B2.1-1-209:1996 (R2007)
| Carbon Steel | 1/8" – 1-1/2" | GTAW, consumable inserts | IN6M-1 & ER70S-2 | As-welded or PWHT | B2.1-1-210:2001 (R2012)
| Carbon Steel | 1/8" – 1-1/2" | GTAW, consumable inserts | IN6M-1, E70S-2 & E70T18 | As-welded or PWHT | B2.1-1-211:2001 (R2012)
| Carbon Steel | 1/8" – 1-1/2" | SMAW | E7018 | As-welded or PWHT | B2.1-1-206:1996 (R2007)

**FC/AW limited to uphill progression only when welding in the vertical position.  /  ***GM/AW, spray transfer limited to flat position only for groove welds.

### Standard Welding Procedure Specification

**Prices:** The user-license one-time fee for each SWPS is $204 ($272 for nonmembers). Not adopted by ASME typesetter.

### Naval Applications

(Requires support of NAVSEA S9074-AQ-GIB-010/248)

| Plate | Carbon Steel | 1/8" – 1-1/2" | GTAW | MIL-70S-2 | As-welded or PWHT | B2.1-1-301:2018
|-------|--------------|----------------|-------|-----------------|-------------------|--------------------------
|       | SMAW         | 1/8" – 1-1/2" | SMAW | MIL-701E-M | As-welded or PWHT | B2.1-1-302:2018
|       | FCAW-G       | 1/8" – 1-1/2" | FCAW-G | MIL-7FT-1 or MIL-71T-1 | As-welded or PWHT | B2.1-1-304:2018
|       | GTAW         | 1/8" – 1-1/2" | GTAW | MIL-3XX-XX | As-welded | B2.1-1-308:2016
|       | SMAW         | 1/8" – 1-1/2" | SMAW | MIL-3XX-XX | As-welded | B2.1-1-309:2018

| Pipe | Carbon Steel | 1/8" – 1-1/2" | GTAW | MIL-70S-2 | As-welded or PWHT | B2.1-1-311:2018
|------|--------------|----------------|-------|-----------------|-------------------|--------------------------
|      | SMAW         | 1/8" – 1-1/2" | SMAW | MIL-701E-M | As-welded or PWHT | B2.1-1-312:2018
|      | FCAW-G       | 1/8" – 1-1/2" | FCAW-G | MIL-7FT-1 or MIL-71T-1 | As-welded or PWHT | B2.1-1-316:2018
|      | GTAW, spray transfer** | 1/8" – 1-1/2" | GTAW | MIL-70S-3 | As-welded or PWHT | B2.1-1-317:2018
|      | SMAW         | 1/8" – 1-1/2" | SMAW | MIL-3XX-XX | As-welded | B2.1-1-319:2018

### Stainess

| Steel | 1/8" – 1-1/2" | GTAW | ER90S-B3 | As-welded (≤1/2") or PWHT | B2.1-4-217:1999 (R2009)
|-------|----------------|-------|-----------|----------------|--------------------------
| Cr-Mo (M-4/P-4) | 1/8" – 3/4" | GTAW | ER90S-B2 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-4-219:1999 (R2009)
| Cr-Mo (M-4/P-4) | 1/8" – 1-1/2" | GTAW, consumable inserts | IN6S-1 & ER6S-B2 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-4-220:1999 (R2009)
| Cr-Mo (M-5/P-5A) | 1/8" – 1-1/2" | GTAW | ER90S-B2 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-4-221:1999 (R2009)
| Cr-Mo (M-5/P-5A) | 1/8" – 1-1/2" | GTAW, consumable inserts | IN6S-1 & ER6S-B2 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-4-222:1999 (R2009)
| Cr-Mo (M-5/P-5A) | 1/8" – 1-1/2" | GTAW | ER90S-B3 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-4-223:1999 (R2009)

### Chrome-Moly Steel

| Steel | 1/8" – 1-1/2" | GTAW | ER90S-B3 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-4-224:1999 (R2009)
|-------|----------------|-------|-----------|----------------|--------------------------
| Cr-Mo (M-5/P-5A) | 1/8" – 3/4" | GTAW, consumable inserts | IN6S-1 & ER6S-B2 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-5-225:1999 (R2009)
| Cr-Mo (M-5/P-5A) | 1/8" – 1-1/2" | GTAW | ER90S-B3, & E9018-B3 | As-welded (≤1/2") or PWHT (all thicknesses) | B2.1-5-228:1999 (R2009)

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**Reference Materials Publications**

*Note: All standards below are adopted by National Board Inspection Code, except B2.1-202.*
Reference Materials Publications

Translations

Chinese
D1.1/D1.1M:2015, Structural Welding Code—Steel see page 76
D1.5M/D1.5:2010, Bridge Welding Code see page 77
WIT-T:2008, Welding Inspection Technology see page 31

Portuguese
D1.1/D1.1M:2010, Structural Welding Code—Steel see page 76

Russian
D1.1/D1.1M:2010, Structural Welding Code—Steel see page 76
API 1104:2013, Welding of Pipelines and Related Facilities 21st Edition see page 72

Spanish
A2.4:2012, Standard Symbols for Welding, Brazing, and Nondestructive Examination see page 40
A3.0M/A3.0:2010, Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying see page 40
B1.10:2009, Guide for the Nondestructive Examination of Welds see page 24

B1.11:2000, Guide for the Visual Examination of Welds see page 24
B4.0:2007, Standard Methods for Mechanical Testing of Welds see page 24
B5.1:2013-AMD1, Specification for the Qualification of Welding Inspectors see page 26
CM:2000, Certification Manual for Welding Inspectors see page 30
D1.1/D1.1M:2015, Structural Welding Code—Steel see page 76
D1.2/D1.2M:2008, Structural Welding Code—Aluminum see page 76
D1.5M/D1.5:2010, Bridge Welding Code see page 77
D15.1/D15.1M:2007, Railroad Welding Specification for Cars and Locomotives see page 75
D17.1:2017 AMD2, Specification for Fusion Welding for Aerospace Applications see page 67
WI:2000, Welding Inspection Handbook see page 24
WIT-T:2000, Welding Inspection Technology see page 31
Z49.1:2012, Safety in Welding, Cutting, and Allied Processes see page 44
API 1104:2013, Welding of Pipelines and Related Facilities 21st Edition see page 72
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The seventeen chapters in this volume cover the fundamentals of welding, cutting, joining, and allied processes. The chapters discuss metallurgy, the physics of welding and cutting, heat flow in welding, and residual stress and distortion. Other important topics include engineering considerations of weld design, weldment tooling and positioning, automation, process monitoring and control, methods for the evaluation and testing of welds, weld quality, weld inspection and nondestructive examination, and the economics of welding. Well-researched chapters on codes and other standards, the qualification and certification of welding techniques and personnel, the accurate communication of welding information, and safe practices are also included. The information in this volume is applicable to all categories of welding, from manual welding to the most sophisticated automated and robotic systems.

The peer-reviewed chapters in this volume are enhanced by the pertinent consensus standards that are referenced throughout. More than 700 drawings, schematics, and photographs illustrate the text. Approximately 170 tables provide categorized or comparative information. Explanatory information and sources are identified and referenced in footnotes.

This volume, like the others preceding it, is a voluntary effort by the members of the Welding Handbook Committee, the Welding Handbook Volume 1 Committee, and the Chapter Committees. Each chapter is reviewed by members of the American Welding Society’s Technical Activities Committee (TAC), Safety and Health Committee (SHC), and other specialists.

Presents comprehensive information on welding and related processes. Contains detailed information on arc welding power sources; shielded metal arc, gas tungsten arc, gas metal arc, flux cored arc, submerged arc, and plasma arc welding processes. Includes chapters on electroslag welding, stud welding, oxyfuel gas welding, brazing, soldering, oxygen cutting, and arc cutting and gouging. 736 pages, 15 chapters, 260 line drawings, 100 photographs, 148 tables, hardbound. 8” x 10”.

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Order Code: WHB-3.9  $196 / $147


Extensively revised and updated from the eighth edition, this comprehensive volume had more than 50 experts in materials and materials applications assure its accuracy and the currency of its content. It is a great reference source for engineers, educators, welding supervisors, and welders. Covers carbon and low-alloy steels; high-alloy steels; coated steels; tool and die steels; stainless and heat-resisting steels; clad and dissimilar metals; surfacing; cast irons; maintenance and repair welding; and underwater welding and cutting. Includes more than 650 pages, 396 line drawings and photos, and 259 tables. 10 chapters, hardbound, 8” x 10”.

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WHC1.02 Physics of Welding and Cutting
WHC1.03 Heat Flow in Welding
WHC1.04 Welding Metallurgy

Part II – Design Considerations

WHC1.05 Design for Welding
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WHC1.07 Residual Stress and Distortion
WHC1.08 Economics of Welding and Cutting

Part III – Automation of Joining Processes

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WHC1.10 Weldment Tooling and Positioning
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WHC2.12: Brazing
WHC2.13: Soldering
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WHC4.08: Cast Irons
WHC4.09: Maintenance and Repair Welding
WHC4.10: Underwater Welding and Cutting

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WHC5.05: Lead and Zinc
WHC5.06: Titanium and Titanium Alloys
WHC5.07: Reactive, Refractory, and Precious Metals
WHC5.08: Plastics
WHC5.09: Ceramics
WHC5.10: Composites
Describes the test methods used to obtain reliable data on the strength of metal-to-metal, metal-to-non-metal, and nonmetal-to-nonmetal joints. 42 pages, 16 figures, 4 tables.
Order Code: C3.2  
$72 / $54

C3.3:2008 (R2016), *Recommended Practices for the Design, Manufacture, and Examination of Critical Brazed Components*
This standard lists the necessary steps to assure the suitability of brazed components for critical applications. Although such applications vary widely, they have certain common considerations with respect to materials, design, manufacture, and inspection. It is the intent of this document to identify and explain these common considerations and the best techniques for dealing with them. It is beyond the scope of this document to provide specific details on these techniques, which the user must adapt to fit each particular application. 56 pages, 4 tables, 1 figure (Reaffirmed 2016).
Order Code: C3.3  
$72 / $54

C3.4M/C3.4:2016, *Specification for Torch Brazing*
This specification presents the minimum fabrication, equipment, and process procedure requirements, as well as inspection requirements for the torch brazing of steels, stainless steels, copper, copper alloys, and heat- or corrosion-resistant alloys and other materials that can be adequately torch brazed (the torch brazing of aluminum alloys is addressed in AWS C3.7M/C3.7, Specification for Aluminum Brazing). This specification provides criteria for classifying torch brazed joints based on loading and the consequences of failure and quality assurance criteria defining the limits of acceptability in each class. The specification defines acceptable torch brazing equipment, materials, and procedures as well as the required inspection for each class of joint. 28 pages.
Order Code: C3.4  
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C3.5M/C3.5:2016-AMD1, *Specification for Induction Brazing*
Includes amendment. This specification provides the minimum fabrication, equipment, and process procedure requirements, as well as inspection requirements for the induction brazing of steels, copper, copper alloys, and heat- and corrosion-resistant alloys and other materials that can be adequately induction brazed (the induction brazing of aluminum alloys is addressed in AWS C3.7M/C3.7, Specification for Aluminum Brazing). This specification provides criteria for classifying induction brazed joints based on loading and the consequences of failure and quality assurance criteria defining the limits of acceptability in each class. The specification defines acceptable induction brazing equipment, materials, and procedures, as well as the required inspection for each class of joint. 30 pages.
Order Code: C3.5  
$68 / $51

C3.6M/C3.6:2016, *Specification for Furnace Brazing*
This specification provides the minimum fabrication, equipment, material, process procedure requirements, as well as inspection requirements for the furnace brazing of steels, copper, copper alloys, and heat- and corrosion-resistant alloys and other materials that can be adequately furnace brazed (the furnace brazing of aluminum alloys is addressed in AWS C3.7M/C3.7, Specification for Aluminum Brazing). This specification provides criteria for classifying furnace brazed joints based on loading and the consequences of failure and quality assurance criteria defining the limits of acceptability in each class. This specification defines acceptable furnace brazing equipment, materials, and procedures, as well as the required inspection for each class of joint. 30 pages.
Order Code: C3.6  
$68 / $51
C3.7M/C3.7:2011, Specification for Aluminum Brazing
The minimum fabrication, equipment, material, process procedure, and inspection requirements for the brazing of aluminum by atmosphere furnace, vacuum furnace, and flux processes. Criteria for classifying aluminum brazed joints based on loading and the consequences of failure and quality assurance criteria defining the limits of acceptability of each class. 32 pages.
Order Code: C3.7
$64 / $48

C3.8M/C3.8:2011, Specification for the Ultrasonic Pulse-Echo Examination of Brazed Joints
Specifies requirements for the contact and immersion pulse-echo ultrasonic examination of brazed joints. Provides the minimum requirements for equipment, procedures, and the documentation of such tests. 28 pages, 4 figures.
Order Code: C3.8
$64 / $48

C3.9M/C3.9:2009, Specification for Resistance Brazing
Minimum fabrication, equipment, material, and process procedure requirements for resistance brazing of steels, copper and alloys, heat and corrosion-resistant materials, and other materials that can be resistance brazed. Criteria for classifying resistance-brazed joints based on loading and consequences of failure, and quality assurance criteria. 24 pages.
Order Code: C3.9
$64 / $48

C3.11M/C3.11:2011, Specification for Torch Soldering
Describes relevant equipment, fabrication procedures, and quality (inspection) requirements for torch soldering. Includes joint classification criteria based on loading and consequences of failure, and quality assurance criteria for each class. 28 pages.
Order Code: C3.11
$64 / $48

This specification provides the minimum requirements for equipment, materials, processing procedures as well as inspection for metal and ceramic base materials that can be furnace soldered. It provides criteria for classifying furnace soldered joints based on loading and the consequences of failure. It also provides quality assurance criteria that define the limits of acceptability in each class. This specification describes acceptable furnace soldering equipment, materials, and procedures, as well as the required inspection for each class of solder joint so produced. 28 pages.
Order Code: C3.12
$64 / $48

see page 26

see page 26

A5.8M/A5.8:2011-AMD1, Specification for Filler Metals for Brazing and Braze Welding
see page 83

A5.31M/A5.31:2012, Specification for Fluxes for Brazing and Braze Welding see page 83
Brazing Handbook
A comprehensive, organized survey of the basics of brazing, processes, and applications. Addresses the fundamentals of brazing, brazement design, brazing filler metals and fluxes, safety and health, and many other topics. A must-have for all brazers, brazing engineers, and students. 740 pages, 36 chapters, 3 appendices, 308 figures, 116 reference tables, fifth edition.
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Soldering Handbook
Covers soldering fundamentals, technology, materials, substrate materials, fluxes, pastes, assembly processes, inspection, and environment. Covers today's advanced joining applications and emphasizes new materials, including higher strength alloys; predictive performance; computer modeling; advanced inspection techniques; new processing concepts, including laser heating; and the resurgence in ultrasonic soldering. 579 pages, 299 figures, 112 tables.
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Guideline for Hand Soldering Practices
This guideline serves as a primer for students, instructors, process engineers, and technical managers involved with manufacturing processes that require hand soldering practices. Instructors and students can consider this guideline as a reference text to instruction manuals, work control procedures, and drawings. Process engineers and technical managers will find this guideline to be an excellent resource for troubleshooting hand soldering processes.
A complementary document to the Soldering Handbook, this guideline is organized to allow quick access to hand soldering knowledge for application to process development and shop floor instructions. 122 pages.
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PURCHASE BRAZING AND SOLDERING HANDBOOK CHAPTERS
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BRAZING HANDBOOK CHAPTERS
1: Basics of Brazing BHC1 $24 / $18
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5: Precleaning and Surface Preparation BHC5 $24 / $18
6: Assembly and Fixturing BHC6 $24 / $18
7: Corrosion of Brazed Joints BHC7 $24 / $18
8: Inspection of Brazed Joints BHC8 $24 / $18
9: Codes and Other Standards BHC9 $24 / $18
10: Safety and Health BHC10 $24 / $18

Specifies requirements for gas tungsten arc welding of austenitic stainless steel tube and pipe at least 1/4 inch (6 mm) diameter in the fabrication of sanitary processing systems for handling products for human and animal consumption. May also be applied to maintenance of food processing equipment. Addresses procedure and performance qualification, fabrication, visual examination requirements, and documentation. 34 pages, 2 figures.

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Laminated sheet with color photograph shows degrees of coloration inside an austenitic stainless steel tube with increasing amounts of oxygen in the backing shielding gas. Suitable as a specifying tool and visual examination guide.

8-1/2" X 11" Order Code: D18.2  
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13" X 19" Order Code: D18.2XL  
$64 / $48


This specification provides the requirements for welding of tanks, vessels, and other equipment used in food processing plants and other areas where sanitary (hygienic) applications are required. The document addresses qualification, fabrication, extent of visual examination, acceptance criteria, and documentation requirements. 32 pages.

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AWS would like to thank our standing partners for their dedication to improving the technology and manufacture of welded products.
C1.1M/C1.1:2012, Recommended Practices for Resistance Welding
Covers spot, seam, projection, flash, and upset welding, as well as weld bonding for uncoated and coated carbon and low-alloy steels, aluminum alloys, stainless steels, nickel, nickel-base alloys, cobalt-base alloys, copper and alloys, and titanium and alloys. Details equipment and setup, welding variables, joint preparation, cleaning, welding schedules and parameters, weld quality testing, safety, and health. 132 pages, 54 tables, 39 figures.
Order Code: C1.1
$108 / $81

C1.4M/C1.4:2017, Specification for Resistance Welding of Carbon and Low-Alloy Steels
Provides the shear strength and weld button diameter requirements for carbon steel and low-alloy steel sheet resistance and projection welds. 34 pages, 5 figures, 6 tables.
Order Code: C1.4
$68 / $51

C1.5:2015, Specification for the Qualification of Resistance Welding Technicians
see page 28

C3.9M/C3.9:2009, Specification for Resistance Brazing see page 55

D8.1M:2013, Specification for Automotive Weld Quality — Resistance Spot Welding of Steel
see page 68

D8.2M:2017, Specification for Automotive Weld Quality—Resistance Spot Welding of Aluminum see page 68

D8.9M:2012, Test Methods for Evaluating the Resistance Spot Welding Behavior of Automotive Sheet Steel Materials see page 68

D17.2/D17.2M:2019, Specification for Resistance Welding for Aerospace Applications
see page 67

J1.1M/J1.1:2013, Specification for Resistance Welding Controls
Provides nomenclature pertaining to the design, construction, and programming of resistance welding controls. Standard calibration and performance parameters as well as labeling and documentation requirements are outlined. Promotes standardization, safety, and proper application of resistance welding controls. 46 pages, 13 figures, 1 table.
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J1.2M/J1.2:2016, Guide to Installation and Maintenance of Resistance Welding Machines
This guide provides general instructions for the installation, operation, and maintenance of common types of resistance welding equipment. Generic preventative maintenance schedules and equipment troubleshooting recommendations are provided as an overview of common weld qualification techniques and corrective actions to common weld conditions. 42 pages, 2 figures.
Order Code: J1.2
$72 / $54
RWMA Bulletin #14: Maintenance Manual for Resistance Welding Machines
Explains installation, maintenance, and operation of a resistance welding machine’s electrical, pneumatic, hydraulic and cooling systems. Includes a trouble-shooting section. Useful for maintenance personnel and operators.
Order Code: RW14 $46 / $35

RWMA Bulletin #16: Resistance Welding Equipment Standards
RWMA standards for welding equipment, including electrical, electrode, and fluid-power standards.
Order Code: RW16 $158 / $119

RWMA Bulletin #34: Manufacturer’s Cross Reference of Standard Resistance Welding Electrode Numbers and Alloys
An extensive cross-reference of standard resistance welding electrodes and alloys recognized by the RWMA. 13 pages.
Order Code: RW34 $48 / $36

Provides information on different welding processes, types and weldability of different materials, and equipment such as machines, electrodes, jigs, fixtures, transformers, controls, and power supplies. Also covers control and maintenance. 468 pages, 25 chapters, 2 appendices (including an index), 308 figures, 85 tables. 8-3/4” x 11-1/4”.
Order Code: RWM $132 / $99

Introduction to Resistance Welding Video
Comprehensive training video illustrates technique, control, and application. Covers spot, projection, seam, and flash/butt welding. Explains basic principles, machine components and setup, electrodes, tooling, controls, and transformers. Ideal for classroom and seminar use, and for introducing a company’s personnel to resistance welding. DVD, 52 minutes.
Order Code: RWVID $132 / $99

QC20:2011, Specification for AWS Certification of Resistance Welding Technicians
see page 23
Provides guidance for assessing the capability and accuracy of computational weld mechanics (CWM) models. Presents current practices for heat transfer, microstructure, residual stress, and distortion calculations. Provides general guidance for implementing verification and validation (V&V) of computational models for complex systems in weld mechanics. 40 pages, 7 figures.
Order Code: A9.5
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This standard establishes safety requirements with respect to the design, manufacture, maintenance, and operation of arc welding robot systems and ancillary equipment. It also helps to identify and minimize hazards involved in maintaining, operating, integrating, and setting up of arc welding robot systems. 33 pages.
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Performance recommendations for evaluating components of a typical robotic or automatic welding installation. A pin arrangement and specific pin function for each location in a standardized 37-pin connector are proposed. 32 pages, 4 figures, 4 tables.
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$68 / $51

Provides recommendations and guidelines for the safe application of robotic arc welding systems. 36 pages, 1 figure, 4 tables.
Order Code: D16.3
$68 / $51

**D16.4M/D16.4:2015, Specification for the Qualification of Robotic Arc Welding Personnel**
see page 28

**AWS D16.6M/D16.6, Specification for Robot Arc Welding Training and Testing Cell**
Applies to the recommended design, integration, installation, and use of robotic arc welding systems used to train and certify operators and technicians under the AWS Certified Robotic Arc Welding (CRAW) program.
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<td>Authoritative guide to select, plan, and control thermal sprayed coatings for preservation of steel. Indispensable for purchasers, architects, managers, supervisors, and contractors in the construction, marine, rail, fabrication, and repair industries. 41 pages, 4 figures, 13 tables (Reaffirmed 2001).</td>
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<td>Covers safety, job reference standards, equipment setup and preparation, surface preparation, aluminum and zinc application, and sealer and topcoat application. Does not cover design and fabrication, thermal spray equipment qualification, coating selection, and operator and inspector certification. Same as NACE No. 12, SSPC-CS 23.00. 48 pages, 9 figures, 5 tables.</td>
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<td>Specification for Thermal Spray Feedstock—Wire and Rods</td>
<td>Classifies solid and composite wires and ceramic rods for thermal spraying, based on their as-manufactured chemical composition. Includes requirements for standard sizes, marking, manufacturing, and packaging. 32 pages, 3 figures, 7 tables (Reaffirmed 2017).</td>
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ASM Handbook Volume 5A: Thermal Spray Technology
Co-published by the Thermal Spray Society and ASM, this volume provides an introduction to modern thermal spray processes, including plasma spray, high velocity oxyfuel, and detonation gun deposition; with a description of coating properties, their wear, corrosion, and thermal barrier characteristics. Principles, types of coatings, applications, performance, and testing/analysis are covered. 400 pages, hardcover.
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Thermal Spraying Practice, Theory, and Application (Historical)
The thermal spraying processes are specialized, yet have a wide ranging utilization in both manufacturing and maintenance. There are many components and variables involved, which, when working together and properly applied, produce an effect far greater than indicated when they are considered individually. Yet each component and variable must be understood to permit the proper selection and operation of a particular process. With this background, the user is then in a position to tailor the process to a particular application. 202 pages, 48 figures, 59 tables.
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Consists of a plastic gauge with samples of oxygen-cut surfaces, a list of descriptive terms, and an accompanying chart. 18 pages (Reaffirmed 2009).
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C4.2/C4.2M:2017, *Recommended Practices for Oxyfuel Gas Cutting Torch Operation*
These recommended practices for oxyfuel gas cutting include the latest procedures to be used in conjunction with oxyfuel gas cutting equipment and the latest safety recommendations. Complete lists of equipment are available from individual manufacturers. 50 pages.
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Describes the best and most practical methods for safe and effective operation of oxyfuel gas heating torches, including information on equipment safety, setup, shutdown and operating procedures, and equipment maintenance. 36 pages, 10 figures, 4 tables.
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Describes methods and techniques for shaping and straightening metal parts (including steel plate, pipes, angles, channel, T bar, and compound structures) by careful application of heat. Presents theory and mathematical formulas for developing heat shaping patterns. Topics include oxyfuel gas equipment (torches, tips, regulators, fuel gases, gas cylinders, and bulk supply); torch procedures for spot, line, and V heating patterns; and safety procedures. Figures show where to place heating patterns for straightening, forming, or bending. 56 pages, 39 figures, 4 tables.
Order Code: C4.4 $76 / $57

C4.5M:2012, *Uniform Designation System for Oxyfuel Nozzles*
Proposes a marking system that includes the name, registration trademark, correct fuel gas symbol, nozzle cutting capacity, and a code or part number to permit easy reference to the manufacturer’s operating data. Provides a common identification system that will result in the safe operation of oxyfuel nozzles, including cutting, welding, heating, and brazing. 18 pages, 1 table, SI (metric) units.
Order Code: C4.5 $60 / $45

Provides the quantitative and qualitative methods for describing and classifying oxyfuel flame, plasma, and laser cutting. 50 pages, 5 annexes, 27 figures, 8 tables (Reaffirmed 2012).
Order Code: C4.6 $76 / $57

C5.3:2000 (R2011), *Recommended Practices for Air Carbon Arc Gouging and Cutting*
Helps the operator establish the correct air pressure, amperage, voltage, and techniques. Includes gouging recommendations and a handy troubleshooting guide. 38 pages, 11 figures, 10 tables (Reaffirmed 2011).
Order Code: C5.3 $68 / $51
C6.1-89 (R2009), *Recommended Practices for Friction Welding*
Describes friction welding fundamentals and basic equipment requirements. Suggested procedure qualification, inspection methods, and joint designs are detailed. Typical mechanical property data are referenced. 46 pages, 3 annexes, 9 figures, 2 tables. (Reaffirmed 2009).
Order Code: C6.1 $68 / $51

Provides for the qualification of friction welding machines, procedures, and training of welding operators. Qualification of welding procedure specifications includes the material specifications involved, weld joint design, and destructive and nondestructive examination requirements, as well as guidelines for categories of quality assurance. Qualification of welding equipment includes weld parameter control and weld reproducibility. 32 pages, 1 table, 4 forms.
Order Code: C6.2 $68 / $51

Presents descriptions of electron beam welding equipment and procedures for welding a wide range of similar and dissimilar metals and thicknesses. Includes sections on safety, process fundamentals, equipment and maintenance, metallurgical and general process considerations, inspection and testing of welds, training and qualification of operators, weld process and procedure development, practical examples, and power curves for various alloys. Also discusses electron beam braze welding, cutting, drilling, surfacing, additive manufacturing, surface texturing, and heat treating. 150 pages, 76 figures, 15 tables.
Order Code: C7.1 $112 / $84

Covers common applications of the process, including drilling and transformation hardening. Describes equipment and procedures. Practical information, including figures and tables, should prove useful in determining capabilities in the processing of various materials. 142 pages, 85 figures, 8 tables.
Order Code: C7.2 $116 / $87

This specification on electron beam welding discusses applicable specifications, safety, requirements, fabrication, quality examination, equipment calibration and maintenance, approval of work, and delivery of work. 36 pages.
Order Code: C7.3 $68 / $51

see page 28

Order Code: D14.8 $92 / $69

A3.1:2010, *Master Chart of Welding and Joining Processes*
24” by 30” chart extracted from A3.0.
Order Code: A3.1 $44 / $33
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D17.1:2017 AMD2, Specification for Fusion Welding for Aerospace Applications
This specification provides the general welding requirements for welding aircraft and space hardware. It includes but is not limited to the fusion welding of aluminum-based, nickel-based, iron-based, cobalt-based, magnesium-based, and titanium-based alloys using electric arc and high energy beam processes. There are requirements for welding design, personnel and procedure qualification, inspection, and acceptance criteria for aerospace, support, and non-flight hardware. Additional requirements cover repair welding of existing hardware. A commentary for the specification is included. 120 pages.
Order Code: D17.1

D17.2/D17.2M:2019, Specification for Resistance Welding for Aerospace Applications
This specification provides the general resistance welding requirements for aerospace resistance spot and seam welding of aluminum, magnesium, iron, nickel, cobalt, and titanium-based alloys. You’ll also find requirements for machine and welding schedule qualification, production witness samples, and inspection and acceptance criteria for aerospace hardware. Intended to replace MIL-W-6858D and AMS-W-6858A. 60 pages, 11 figures, 13 tables.
Order Code: D17.2 $80 / $60

Specifies general requirements for friction stir welding of aluminum alloys for aerospace applications. Includes the requirements for weldment design, qualification of personnel and procedures, fabrication, and inspection. 58 pages, 28 figures, 5 tables.
Order Code: D17.3 $76 / $57

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  May 15, 2019 – May 16, 2019
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  Aug 29, 2019 – Aug 30, 2019
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  Sep 17, 2019 – Sep 19, 2019
- 2019 Aerospace Joining Conference
  Sep 23, 2019 – Sep 26, 2019
- 2020 Inspection Conference
  Jan 21, 2020 – Jan 23, 2020
- International Brazing and Soldering Conference
  Mar 15, 2020 – Mar 18, 2020

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D8.1M:2013, Specification for Automotive Weld Quality — Resistance Spot Welding of Steel
Establishes acceptance criteria for resistance spot welds in autos fabricated from steel, including Advanced High Strength Steels. 38 pages, 24 figures, 4 tables.
Order Code: D8.1  $68 / $51

D8.2M:2017, Specification for Automotive Weld Quality — Resistance Spot Welding of Aluminum
This document contains both visual and measurable acceptance criteria for resistance spot welds in aluminum. The information contained herein may be used as an aid by designers, resistance welding equipment manufacturers, welded product producers, and others involved in the automotive industry and resistance spot welding of aluminum. 40 pages.
Order Code: D8.2  $72 / $54

D8.8M:2014, Specification for Automotive Weld Quality — Arc Welding of Steel
Provides the minimum quality requirements for arc welding of various types of automotive and light truck components. Covers the arc and hybrid arc welding of coated and uncoated steels. 28 pages, 17 figures.
Order Code: D8.8  $64 / $48

Helps predict performance of sheet steel that is resistance spot welded for use in auto manufacturing. Also addresses equipment setup, electrode installation and dressing, electrode endurance testing, current level and range assessment, weld property testing, current break-through testing, and design of experiments testing. 124 pages, 47 figures, 22 tables.
Order Code: D8.9  $108 / $81

This specification covers the arc welding of automotive components that are manufactured from aluminum alloys. 42 pages.
Order Code: D8.14  $72 / $54

Includes amendment. Specifies requirements for welding of all principal structural weldments and all primary welds used to manufacture cranes for industrial, mill, powerhouse, and nuclear facilities. Applies to other overhead material-handling machinery and equipment that support and transport loads within the design rating, vertically or horizontally, during normal operations. When agreed upon between owner and manufacturer, it may apply to loading caused by abnormal operations or environmental events, such as seismic loading. All provisions apply to strengthening and repairing of existing overhead cranes and material handling equipment. Contains figures and tables with prequalified joint details, allowable stress ranges, stress categories, and nondestructive examination techniques. Does not apply to construction or crawler cranes or welding of rails. 150 pages, 60 figures, 21 tables.

Order Code: D14.1 $120 / $90


Includes amendment. For self-propelled, on- and off-highway machinery and agricultural equipment. Specifies requirements for structural welds used in the manufacture and repair of crawlers, graders, loaders, off-highway trucks, power shovels, backhoes, mobile cranes, draglines, and other heavy earthmoving, construction, and agricultural equipment. Provides exhaustive illustrations of prequalified complete and partial penetration welded joints (butt, corner, T-, or combination) for shielded metal arc welding, submerged arc welding, gas metal arc welding, and flux cored arc welding. Includes variables for prequalified fillet welds. Annexes include “Recommended Practices for Treatment of Shielded Metal Arc and Flux Cored Arc Electrodes.” Tables include “Weldability Classification—Typical Steel Products” and “Minimum Preheat and Interpass Temperatures.” 94 pages, 22 figures, 13 tables.

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Chinese Edition $92 / $69


Specifies common acceptance criteria for carbon and low-alloy steel welded joints in machines and equipment subject to static and dynamic loading. Covers classification of welded joints, weld joint design, workmanship, quality control requirements and procedures, welding operator and procedure qualification, weld joint inspection (visual, radiographic, ultrasonic, magnetic particle, liquid penetrant), repair, and postweld treatments. Describes the effect of weld joint geometry, welding practices, and quality control on allowable stress levels, and provides practices for qualification and examination of welded joints in machinery and equipment fabrication. Contains figures and tables with typical joint details, nondestructive examination techniques, and weld-inspection criteria. 122 pages, 38 figures, 16 tables.

Order Code: D14.4 $108 / $81


Presents the current minimum standards and guidelines for the welded fabrication and repair of presses and press components. Addresses classification, weld joint design, stresses, tolerances, welder qualification, and a welding quality program. 158 pages, 69 figures, 24 tables, 3 forms.

Order Code: D14.5 $120 / $90
Specifies the requirements for weld joint detail and fabrication by welding of rotating elements for new equipment and modification or repair of existing equipment. Equipment types include, but not limited to: crushers, fans, impellers, centrifugal impellers, kilns, pulpers, gears, sheaves, drive trains, cranks shafts, flywheels, power transmission shafts, air moving devices, blowers, and rotating elements of hydroelectric generation equipment. The intent of this specification is not to include steam or combustion turbine rotors, blading, or camshafts. This specification includes requirements for welding procedure and welder performance qualification and inspection and quality control and refers to AWS B2.1/B2.1M for base material specifications and groupings (BMG), tables for welding consumable F and A numbers, welding positions, test fixtures, macroetch procedures, and sample forms. 86 pages, 10 tables, 19 figures.
Order Code: D14.6 $88 / $66

Provides guidance on surfacing, repair, and reconditioning of industrial mill rolls in the heavy metals, paper, plastic, and lumber industries. Emphasizes the use of submerged arc welding, but also addresses gas metal arc welding, and flux cored arc welding, with suitable modifications. Applicable to electroslag cladding. Covers welding, postweld heat treating, finish machining, inspection, and record keeping. Provides detailed guidelines, tables, figures, and forms for use in establishing documented, qualified Welding Procedure Specifications. 66 pages, 20 figures, 13 tables.
Order Code: D14.7 $80 / $60

see page 65

Provides standards for the design and manufacture of pressure containing welded joints and structural welded joints used in the manufacture of hydraulic cylinders. Manufacturer’s responsibilities are presented as they relate to the welding practices that have been proven successful within the industry in the production of hydraulic cylinders. Included are sections defining welding procedure qualification, welder performance qualification, workmanship and quality requirements, as well as inspection requirements and repair requirements. 49 pages, 17 figures, 6 tables.
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D3.5-93R(2000), *Guide for Steel Hull Welding*
Best practical methods to weld steel hulls for ships, barges, mobile offshore drilling units, and other marine vessels. Includes information on steel plates, shapes, castings, and forgings, their selection, and their weldability. 118 pages, 72 figures, 9 tables. (Reaffirmed 2000).
Order Code: D3.5
$104 / $78

D3.6M:2017, *Underwater Welding Code*
This code covers the requirements for welding structures or components under the surface of water. It includes welding in both dry and wet environments. Clauses 1 through 8 constitute the general requirements for underwater welding, while clauses 9 through 11 contain the special requirements applicable to three individual classes of weld as follows:
- Class A—Comparable to above-water welding
- Class B—For less critical applications
- Class O—to meet the requirements of another designated code or specification.
146 pages, 47 figures, 13 tables, 4 forms, commentary.
Order Code: D3.6
$116 / $87

Guidance on proven processes, techniques, and procedures for welding aluminum hulls and related ship structures. Chiefly for aluminum hulls over 30-ft. (9-m) long and made of sheet and plate 3/16-in. (4.8-mm) thick and greater. Sections on hull materials, construction preparation, welding equipment, processes, procedure and performance qualification, welding techniques, and safety. 86 pages, 11 figures, 18 tables.
Order Code: D3.7
$88 / $66

Specifies the classification requirements for weld-through paint primers for paint manufacturers, based on the maximum coating thickness and welding procedure used in testing. 20 pages, 1 figure, 1 table.
Order Code: D3.9
$64 / $48

A5.35/A5.35M:2015-AMD1, *Specification for Covered Electrodes for Underwater Wet Shielded Metal Arc Welding*
Includes amendment. This specification establishes the requirements for classification of covered electrodes for underwater wet shielded metal arc welding. The requirements include mechanical properties of weld metal, weld metal soundness, and usability of electrode. Requirements for composition of the weld metal, standard sizes and lengths, marking, manufacturing, and packaging are also included. 36 pages, 3 figures, 6 tables.
Order Code: A5.35
$72 / $54

Standard Welding Procedure, *Specifications for Naval Applications (SWPS-Ns)*
see page 49
The purpose of this standard is to present methods for the production of high quality welds through the use of qualified welders using approved welding procedures, materials, and equipment. Its purpose is also to present inspection methods to ensure the proper analysis of welding quality through the use of qualified technicians and approved methods and equipment. It applies to both new construction and in-service welding.

Order Code: API1104
Spanish edition $345
Russian edition $345

**D10.4-86R, Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing**

Detailed discussion of the metallurgical characteristics and weldability of many grades of austenitic stainless steel used in piping and tubing. The delta ferrite content as expressed by ferrite number (FN) is explained, and its importance in minimizing hot cracking is discussed. Figures and tables illustrate recommended joint designs and procedures. Appendix A presents information on the welding of high-carbon stainless steel cast pipe fittings. 42 pages. (Reaffirmed 1992).

Order Code: D10.4
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Incorporates results of research on the effects of atmospheric exposure during welding. Provides coverage on power sources, tungsten electrodes, titanium base metal grades, filler metals, joint design and preparation, pickling and cleaning, fitting and tacking, preweld cleaning, gas shielding, welding procedures and techniques, and preheat and postweld heat treatment. 28 pages, 4 figures, 7 tables.

Order Code: D10.6
$64 / $48

**D10.7M/D10.7:2008, Guide for the Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe**

A comprehensive guide for the selection of filler metals that incorporates all the important weld metal characteristics. 56 different base metals and 13 filler metals are evaluated for weldability, strength, ductility, corrosion resistance, service temperature and color matching. 42 pages, 5 figures, 13 tables.

Order Code: D10.7
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**D10.8-96, Recommended Practices for Welding of Chromium-Molybdenum Steel Piping and Tubing**

Recommendations for welding chromium-molybdenum steel pipe and tubing to itself and to various other materials. Covered in detail are filler metal selection, joint design, preheating, and postheating. Emphasis is placed on maintaining interpass temperature and dangers inherent in interrupted heating cycles. 18 pages, 1 figure, 4 tables.

Order Code: D10.8
$60 / $45

**D10.10/D10.10M:1999 (R2009), Recommended Practices for Local Heating of Welds in Piping and Tubing**

Provides information on recommended practices, equipment, temperature control, insulation, and advantages and disadvantages for the methods presently available for local heating of welded joints in pipe and tubing. 116 pages, 8 annexes, 23 figures, 16 tables (Reaffirmed 2009).

Order Code: D10.10
$104 / $78

Presents guidelines for welding the root pass of metal pipe butt joints with an open root or a consumable insert. Joint designs, assembly, consumable insert configurations, base metals, filler metals, and purging are discussed. Applicable arc welding processes and techniques are described. 34 pages, 11 figures.

Order Code: D10.11 $68 / $51

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Contains recommended practices for welding piping systems of sizes DN 200 (NPS 8) and under and wall thickness of 13mm (0.5 in) and under for low-pressure heating, air conditioning, refrigeration, and water supply, as well as some gas and chemical systems. Covers carbon steels such as ASTM A53, A106, A135, A179, A524, A587, and API-5L, Grades A25, A and B, and X42 joined using oxyacetylene, shielded metal arc, gas tungsten arc, gas metal arc, and flux cored arc welding. Explains techniques for preheating, joint preparation, alignment and positioning, fittings, and root and hot passes. Does not address the needs of pipe steels or service conditions that may require postweld heat treatment. 48 pages, 19 line drawings and photographs, 10 tables.

Order Code: D10.12 $68 / $51

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Extensive guidance on multipass orbital machine pipe groove welding for both plant and transmission applications. 76 pages, 29 figures, 1 table.

Order Code: D10.14 $88 / $66

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This standard presents a detailed discussion of the metallurgical and welding characteristics and weldability of duplex stainless steel used in piping and tubing. 38 pages.

Order Code: D10.18 $72 / $54

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**D18.2:2009, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube** see page 58

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**F4.1:2017, Safe Practices for the Preparation of Containers and Piping for Welding, Cutting, and Allied Processes** see page 45

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Pipe Welding Standard Welding Procedure Specifications (SWPSs) see page 49
B2.4:2012, Specification for Welding Procedure and Performance Qualification for Thermoplastics see page 26

G1.1M/G1.1:2006, Guide to Ultrasonic Assembly of Thermoplastics
Details the ultrasonic equipment and processes used in fabricating thermoplastic parts. 94 pages, 45 figures, 9 tables.
Order Code: G1.1
$92 / $69

G1.2M/G1.2:1999 (R2010), Specification for Standardized Ultrasonic Welding Test Specimen for Thermoplastics
Helps minimize variations in the geometry, welding, and testing of the ultrasonic welding test sample for thermoplastics. Detailed figures show tolerances on critical dimensions that may affect weldability. Use this specification for studies on the ultrasonic welding of thermoplastics, weldability studies, and optimizations. 36 pages. (Reaffirmed 2010).
Order Code: G1.2
$64 / $48

G1.6:2006, Specification for the Qualification of Plastics Welding Inspectors for Hot Gas, Hot Gas Extrusion, and Heated Tool Butt Thermoplastic Welds see page 29

G1.10M:2016, Guide for the Evaluation of Thermoplastic Welds
This standard lists and describes flaws and defects in hot gas, hot gas extrusion, heated tool butt fusion, socket fusion, electrofusion, and flow fusion welded joints in thermoplastics. Its intent is to make possible a generally valid evaluation giving consideration to graded quality requirements. 60 pages
Order Code: G1.10
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D15.1/D15.1M:2012-AMD1, *Railroad Welding Specification for Cars and Locomotives*
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Order Code: D15.1

D15.2/D15.2M:2013, *Recommended Practices for the Welding of Rails and Related Rail Components for Use by Rail Vehicles*
Recommends the minimum standards for the welding of rails and related rail components used by rail vehicles. Covers repair procedures for rails and austenitic manganese steel components, thermite welding, electric flash welding guidelines, procedure qualification, and welder qualification. 64 pages, 23 figures, 7 tables.
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Order Code: D1.4  
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- A2.4:2012, Standard Symbols for Welding, Brazing, and Nondestructive Examination
- A3.0M/A3.0:2010, Standard Welding Terms and Definitions

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Bundle B
- D1.1/D1.1M:2015, Structural Welding Code–Steel
- D1.2/D1.2M:2014, Structural Welding Code–Aluminum
- D1.4/D1.4M:2018, Structural Welding Code–Steel Reinforcing Bars
- D1.5M/D1.5:2015-AMD1, Bridge Welding Code
- D1.6/D1.6M:2017, Structural Welding Code–Stainless Steel

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Bundle C
- A2.4:2012, Standard Symbols for Welding, Brazing, and Nondestructive Examination
- D1.5M/D1.5:2015-AMD1, Bridge Welding Code

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Bundle D(Seismic Bundle)
- D1.1/D1.1M:2015, Structural Welding Code–Steel
- D1.8/D1.8M:2016, Structural Welding Code–Seismic Supplement

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C1.4M/C1.4:2017, Specification for Resistance Welding of Carbon and Low-Alloy Steels see page 59

D11.2-89 (R2006), Guide for Welding Iron Castings
Briefly presents the history and metallurgy of cast iron and its welding processes. A weldability test is described, with instructions for its application in specific cases. Qualification of procedures and welders and quality control practice are also included. 208 pages, 71 figures, 27 tables. (Reaffirmed 2006).
Order Code: D11.2 $112 / $84

G2.1M/G2.1:2012, Guide for the Joining of Wrought Nickel-Based Alloys
Definitive guide to welding metals and alloys not covered by other standards. Guidelines for welding different wrought nickel-based alloys, including solid-solution and precipitation-hardening alloys. 66 pages, 5 figures, 16 tables.
Order Code: G2.1 $80 / $60

G2.3M/G2.3:2019, Guide for the Joining of Solid Solution Austenitic Stainless Steels
Presents a description of solid solution austenitic stainless steels and the processes and procedures that can be used for the joining of these materials. Discusses the welding processes and welding parameters, qualifications, inspection and repair methods, cleaning, and safety considerations. New content on reheat cracking in FCAW deposits and stabilization anneal heat treatment. Practical information has been included in the form of figures, tables, and graphs that should prove useful in determining capabilities and limitations in the joining of austenitic stainless steels. 112 pages, 32 tables, 7 figures.
Order Code: G2.3 $104 / $78

Order Code: G2.4 $76 / $57

G2.5/G2.5M:2012, Guide for the Fusion Welding of Zirconium and Zirconium Alloys
First-time users of zirconium along with established fabricators will find this to be a useful guide to best practices for joining zirconium parts. 46 pages, 6 figures, 10 tables.
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This practical guide for troubleshooting stainless steel welding problems is an organized collection of 15 years of questions and answers from Dr. Damian Kotecki’s column in the Welding Journal.
Order Code: WQS $168 / $126

Welding Zinc-Coated Steels see page 47
56 pages, 17 figures, 14 tables, 7 annexes. (Reaffirmed 2014).
Order Code: A4.2
$72 / $54

26 pages (Approved by ANSI in 2018).
Order Code: A4.3
$72 / $54

A4.4M:2001 (R2016), Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings
32 pages, 4 figures, 3 tables (Reaffirmed 2016).
Order Code: A4.4
$72 / $54

24 pages, 3 figures.
Order Code: A4.5
$72 / $54

A5.01M/A5.01:2013 (ISO 14344:2010 MOD), Welding Consumables – Procurement of Filler Metals and Fluxes
Essential to today’s purchaser. Provides a means by which the information needed for the procurement of welding consumables to an AWS, ISO, or other filler metal specification can be stated clearly, concisely, and completely. 38 pages, 9 tables.
Order Code: A5.01
$72 / $54

A5.02/A5.02M:2007, Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes
Prescribes size, package, appearance, and identification requirements for filler metals for solid, tubular, bare, covered, and strip electrodes used in fusion processes, but not brazing, braze welding, thermal spraying, or granular products such as SAW fluxes. 28 pages, 4 figures, 4 tables.
Order Code: A5.02
$72 / $54

A5.32M/A5.32:2011 (ISO 14175:2008 MOD), Welding Consumables – Gases and Gas Mixtures for Fusion Welding and Allied Processes
42 pages, 5 tables.
Order Code: A5.32
$72 / $54

C2.25/C2.25M:2012 (R2018), Specification for Thermal Spray Feedstock—Wire and Rods
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AWS FILLER METAL SPECIFICATIONS BY MATERIAL AND WELDING PROCESS

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