AWS ONLINE LEARNING:
WELDING EDUCATION ON THE GO

◆ **FREE*** Online Safety in Welding course.

Learn more at [aws.org/courses](http://aws.org/courses)

*Safety in Welding Course is free to view. For Certificate of Completion or PDHs, enrollment fee will be required.
NEW IN THIS CATALOG

A2.4:2020, Standard Symbols for Welding, Brazing, and Nondestructive Examination 43
A4.3:1993-ADD1, Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding 76
A5.39/A5.39M, Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys 78
C3.8M/C3.8:2020, Specification for the Ultrasonic Pulse-Echo Examination of Brazed Joints 55
AASHTO/AWS D1.5M/D1.5:2020, Bridge Welding Code 72
F4.2:2020, Safety Guidelines for Proper Selection of Welding Cables 46

CONTENTS

PROFESSIONAL AND CAREER DEVELOPMENT

WELDING PROCESS PUBLICATIONS
Brazing and Soldering 54
Food Processing Systems 58
Resistance Welding 59
Robotics & Automation 61
Thermal Spraying 62
Welding and Cutting Processes 63

INDUSTRY APPLICATION PUBLICATIONS
Aerospace 65
Automotive 65
Machinery 66
Marine 68
Pipe & Tubing 69
Plastics 71
Railroad 71
Structural 72

MATERIALS PUBLICATIONS
Base Metal Weldability 75
Consumables & Related Products 76
Filler Metal Specifications 77
Sheet Metal 79

INDEXES
Publications Subject Index 81
Publications Code Number Index 90

RESOURCES
Certification, Endorsement, and Accreditation Programs 6
Conference Programs 26
Instructor-Led Seminar Programs 14
Online Courses 16
Online Code Clinics 18
Industry Partner Courses 19
Membership Programs 27
Publications & Resources
  Certification 30
  Inspection 32
  Qualification 33
  Training 37

EXPOSITION PROGRAMS
FABTECH Events
  FABTECH USA 39
  FABTECH Mexico 39
  FABTECH Canada 39

ACADEMIC RESOURCES
Fundamentals of Welding Curriculum 22
AWS Digital Library 40
AWS Online Educational Library 24
AWS SENSE Program 23

REFERENCE MATERIALS PUBLICATIONS
ISO Standards 42
Reference and Business 43
Safety and Health 45
Standard Welding Procedure Specifications (SWPS) 48
Translations 50
Welding Handbooks 51
ADVANCE YOUR WELDING CAREER WITH ONE OF AWS’ SUITE OF PROFESSIONAL CERTIFICATIONS

American Welding Society Certifications offer an opportunity to demonstrate your knowledge, skills, and abilities that can enhance your career in the welding industry. Nine different certification categories are available to support your success.

- Certified Welder (CW)
- Certified Welding Inspector (CWI)
- Certified Resistance Welding Technician (CRWT)
- Certified Radiographic Interpreter (CRI)
- Certified Robotic Arc Welding Operator or Technician (CRAW)
- Certified Welding Educator (CWE)
- Certified Welding Engineer (CWEng)
- Certified Welding Sales Representative (CWSR)
- Certified Welding Supervisor (CWS)

NEW MEMBER BONUS
Become an AWS Member and purchase an AWS publication for $35 - up to a 82% discount! You can choose from a list of over 20 popular titles, including the Welding Handbook.
American Welding Society Certifications offer an opportunity to learn new skills, boost a career and provide additional education for those in the welding industry. For the past century, the American Welding Society (AWS) has pioneered the advancement of uniform practices and procedures used throughout the welding industry. Today, AWS Standards are used to ensure safety and conformity of weld quality in a multitude of industries worldwide. Welding technicians and professionals certified through AWS have proved their knowledge of and commitment to upholding these standards.
CERTIFICATION, ENDORSEMENT, AND ACCREDITATION PROGRAMS

Certification Programs for Individuals

CERTIFIED WELDER (CW)
The Certified Welder program is a performance-based credential that tests the candidate's practical skills and application of procedures used in the structural steel, petroleum pipelines, sheet metal, and chemical refinery welding industries.

CERTIFIED WELDING INSPECTOR (CWI)
The Certified Welding Inspector program evaluates the candidate's understanding of welding inspection concepts and principles, ability to locate and understand information within the specific code book, and knowledge of welds.

SENIOR CERTIFIED WELDING INSPECTOR (SCWI)
Expands on the education, knowledge and experience of the CWI and evaluates the candidate's ability to solve more complicated weldment issues.

CERTIFIED ASSOCIATE WELDING INSPECTOR (CAWI)
Candidates who do not possess sufficient experience to qualify for CWI status may choose to take the CWI exam to achieve Associate Welding Inspector status.

CERTIFIED WELDING SUPERVISOR (CWS)
Certified Welding Supervisors are tested on their ability to manage resources, improve productivity and increase profitability based on their knowledge of welding safety, planning, fabrication, inspection, documentation, and economics.

CERTIFIED WELDING EDUCATOR (CWE)
The Certified Welding Educator program validates an educator's ability to direct and perform operations associated with welder training and classroom instruction against the nationally recognized AWS standard.

CERTIFIED WELDING ENGINEER (CWEng)
The Certified Welding Engineer credential demonstrates that the holder possesses education and experience to oversee welding operations in accordance with appropriate codes and other documentation associated with weldments and other types of joints.

CERTIFIED RADIOGRAPHIC INTERPRETER (CRI)
The Certified Radiographic Interpreter program certifies the ability to properly identify and assess welding-related indications (e.g. proper film exposure, correct selection of image quality indicators and characterization of indications) produced on radiographic film and related media against acceptance criteria from AWS, API, and ASME codes.

CERTIFIED ROBOTIC ARC WELDING TECHNICIAN/OPERATOR (CRAW-T/CRAW-O)
The Certified Robotic Arc Welding exam tests the experience, education and training needed to effectively operate a robotic welding cell. Depending on the level of experience, individuals who pass a written exam and performance test can be certified as either robotic arc welding operators or technicians.

CERTIFIED WELDING SALES REPRESENTATIVE (CWSR)
The Certified Welding Sales Representative (CWSR) program establishes an individual's skills, knowledge, and experience concerning basic terminology, processes, equipment and supplies used in welding sales.

CERTIFIED RESISTANCE WELDING TECHNICIAN (CRWT)
The Certified Resistance Welding Technician (CRWT) credential was developed jointly by AWS and RWMA – provides a nationally recognized benchmark for the evaluation of resistance welding personnel, testing their knowledge, skills and abilities in conducting the setup, operation, maintenance, testing and quality control of resistance welding equipment.
CERTIFICATION, ENDORSEMENT, AND ACCREDITATION PROGRAMS

Endorsement Programs for Certified Welding Inspectors

Certified Welding Inspectors (CWIs) and Senior Certified Welding Inspectors (SCWIs) may supplement their credentials by passing an exam on one or more of 12 endorsement options available through AWS.

Each endorsement focuses on a specific portion of welding code in conformance with codebook examination requirements found in AWS B5.1, Specification for the Qualification of Welding Inspectors, Section 7.1, and covers four subject areas: material and design, fabrication, inspection, and qualification. These endorsements also provide necessary PDHs toward renewal or recertification.

NEW ENDORSEMENT:
WELDER PERFORMANCE QUALIFIER
Validates the holder’s ability to qualify welders for certification according to AWS standards and satisfies an “Alternate Qualification” requirement for SCWI certification.

D1.1 STRUCTURAL STEEL WELDING CODE ENDORSEMENT
D1.2 STRUCTURAL ALUMINUM WELDING CODE ENDORSEMENT
D1.5 BRIDGE WELDING CODE ENDORSEMENT
D15.1 RAILROAD WELDING SPECIFICATION FOR CARS AND LOCOMOTIVES ENDORSEMENT
D17.1 SPECIFICATION FOR FUSION WELDING OF AEROSPACE APPLICATIONS ENDORSEMENT
API 1104 WELDING OF PIPELINES AND RELATED FACILITIES ENDORSEMENT

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. Candidates are tested on PT fundamentals using the AWS PT Book of Specifications to answer a combination of multiple choice questions, a written portion and a practical examination.

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. Candidates are tested on MT fundamentals using the AWS MT Book of Specifications to answer a combination of multiple choice questions, a written portion and a practical examination.

AWS STRUCTURAL BOLTING INSPECTION - BUILDING STRUCTURES ENDORSEMENT
This endorsement tests the candidate’s knowledge of material and design, fabrication, inspection, and qualification of RCSC 30 June 2004, AISC LRFD (Load and Resistance Factor Design) THIRD EDITION and AISC Steel Construction Manual, Thirteenth Edition.

AWS STRUCTURAL DRAWING READING - BUILDING STRUCTURES ENDORSEMENT
This endorsement tests the candidate’s knowledge of structural construction drawings, blueprint standards, computer-aided design, sections, elevations, schedules, site plans and architectural plans of both residential dwellings and commercial structures.

ASME PRESSURE VESSEL SECTION IX, PRESSURE PIPING B31.1 AND B31.3 ENDORSEMENT
This endorsement tests the candidate’s knowledge of material and design, fabrication, inspection, and qualification as presented in ASME standards B31.1 (Power Piping), ASME B31.3 (Process Piping), and Section IX of the ASME Code.

ASME PRESSURE VESSEL SECTION VIII, DIV. 1 AND SECTION IX ENDORSEMENT
This endorsement tests the candidate’s knowledge of material and design, fabrication, inspection, and qualification as presented in Section VIII and Section IX of the ASME Boiler and Pressure Vessel Code.
**CERTIFICATION PROGRAMS 2020 PRICE LIST**

### INSPECTOR (CAWI, CWI, SCWI)

<table>
<thead>
<tr>
<th>Service Description</th>
<th>+Member</th>
<th>*Non Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial CAWI, CWI Exams•</td>
<td>$1,070</td>
<td>$1,325</td>
</tr>
<tr>
<td>Initial CAWI, CWI and Part B Training•</td>
<td>$1,580</td>
<td>$1,835</td>
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<tr>
<td>CWI by Reciprocity with CWB or INWC</td>
<td>$560</td>
<td>$815</td>
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<tr>
<td>Upgrade CAWI to CWI</td>
<td>$270</td>
<td>$525</td>
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<tr>
<td>Prometric Initial SCWI•</td>
<td>$1,070</td>
<td>$1,325</td>
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<tr>
<td>Endorsement Structural Drawing Reading</td>
<td>$310</td>
<td>$565</td>
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<tr>
<td>Prometric Endorsement Exam</td>
<td>$370</td>
<td>$625</td>
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<tr>
<td>Prometric Endorsement MT Exam•</td>
<td>$430</td>
<td>$685</td>
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<tr>
<td>Prometric Endorsement PT Exam•</td>
<td>$430</td>
<td>$685</td>
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Endorsement MT/PT Exam Part B • Contact ATF for pricing.

### RETEST

<table>
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<tr>
<th>Service Description</th>
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<tbody>
<tr>
<td>CAWI, CWI, CWE (Part A Or C)•</td>
<td>$370</td>
<td>$370***</td>
</tr>
<tr>
<td>CAWI, CWI, CWE (Part A and C)•</td>
<td>$740</td>
<td>$740***</td>
</tr>
<tr>
<td>CAWI, CWI, CWE (Part B)</td>
<td>$310</td>
<td>$310***</td>
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<tr>
<td>CAWI, CWI, CWE (ALL parts)•</td>
<td>$785</td>
<td>$1,040</td>
</tr>
<tr>
<td>CAWI, CWI, CWE (Part B/Part B Training)</td>
<td>$1,240</td>
<td>$1,335**</td>
</tr>
<tr>
<td>Prometric SCWI•</td>
<td>$785</td>
<td>$1,040</td>
</tr>
<tr>
<td>Prometric Endorsement MT/PT (One Part A or C)•</td>
<td>$370</td>
<td>$370***</td>
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<tr>
<td>Prometric Endorsement MT/PT (Two Part)^•</td>
<td>$430</td>
<td>$685</td>
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Endorsement MT/PT Exam Part B • Contact ATF for pricing.

### PACKAGES

<table>
<thead>
<tr>
<th>Service Description</th>
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<tbody>
<tr>
<td>CWI Seminar and Exam Package (D1.1 Focus)•</td>
<td>$2,585</td>
<td>$2,840</td>
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<tr>
<td>- CWI Pre-Seminar (online course)</td>
<td>$750</td>
<td>$750***</td>
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<tr>
<td>CWI Seminar and Exam Package (API 1104 Focus)•</td>
<td>$2,585</td>
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<tr>
<td>- CWI Pre-Seminar (online course)</td>
<td>$750</td>
<td>$750***</td>
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### CLINICS/SEMINARS/WORKSHOPS (Exam not Included)

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<tr>
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<tr>
<td>CWI Seminar Week (D1.1 Focus)</td>
<td>$1,865</td>
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<tr>
<td>CWI Seminar Week (API 1104 Focus)</td>
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<tr>
<td>Seminar Retake (within 12 months of original event)</td>
<td>$845</td>
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<tr>
<td>Part B Training Seminar Only</td>
<td>$930</td>
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<tr>
<td>CWI Pre-Seminar (online course)</td>
<td>$865</td>
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<tr>
<td>Welding Fundamentals I (online course)</td>
<td>$350</td>
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### RENEWAL

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<tbody>
<tr>
<td>CWI/SCWI 3rd and 6th Year Renewal by Work Experience</td>
<td>$525</td>
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<td>CWI/SCWI 3rd and 6th Year Renewal by Examination</td>
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<td>CWB or INWC Renewal by Reciprocity</td>
<td>$480</td>
<td>$735</td>
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### 9-YEAR RECERTIFICATION

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<tr>
<th>Service Description</th>
<th>+Member</th>
<th>*Non Member</th>
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<tbody>
<tr>
<td>CWI Part B Exam</td>
<td>$975</td>
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<tr>
<td>SCWI Part A &amp; B Examss</td>
<td>$1,095</td>
<td>$1,350</td>
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<tr>
<td>CWI Part B Exam/Part B Training</td>
<td>$1,905</td>
<td>$2,160</td>
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<tr>
<td>CWI/SCWI Endorsement Structural Drawing Reading Exam</td>
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<td>$1,230</td>
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<tr>
<td>CWI/SCWI Non-Exam</td>
<td>$665</td>
<td>$920</td>
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</table>

* Initial CRI Certification

### CERTIFIED WELDING EDUCATOR (CWE)

<table>
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<th>+Member</th>
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<tr>
<td>Exam Only•</td>
<td>$770</td>
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<td>Non-Exam</td>
<td>$405</td>
<td>$660</td>
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<tr>
<td>Retest</td>
<td>$355</td>
<td>$610</td>
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<tr>
<td>Renewal</td>
<td>$345</td>
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### CWE FOR SENSE PARTICIPANTS ONLY

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<th>Service Description</th>
<th>+Member</th>
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<tbody>
<tr>
<td>Exam•</td>
<td>$370</td>
<td>$625</td>
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<tr>
<td>Retest</td>
<td>$355</td>
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<tr>
<td>Retest (Single Part)</td>
<td>$310</td>
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<td>Renewal CWE Only</td>
<td>$225</td>
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### CERTIFIED RADIOGRAPHIC INTERPRETER (CRI)

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<tbody>
<tr>
<td>Exam</td>
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<tr>
<td>Seminar Only</td>
<td>$1,407</td>
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<td>Initial Seminar and Exam</td>
<td>$1,833</td>
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<tr>
<td>Retest (All Parts)</td>
<td>$615</td>
<td>$615***</td>
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<tr>
<td>Retest (Per Part)</td>
<td>$310</td>
<td>$310***</td>
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<tr>
<td>Renewal by Work Experience</td>
<td>$500</td>
<td>$755</td>
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<tr>
<td>Renewal by Part B Exam</td>
<td>$720</td>
<td>$975</td>
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9yr Recertification by Part B • Contact ATF for pricing.
<table>
<thead>
<tr>
<th>CERTIFICATION PROGRAMS 2020 PRICE LIST</th>
</tr>
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<tbody>
<tr>
<td><strong>CERTIFIED WELDING SUPERVISOR (CWS)</strong></td>
</tr>
<tr>
<td>Prometric Examss</td>
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<tr>
<td>Prometric Retest (Per Part)s</td>
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<td>Renewal</td>
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<td>9-yr Recertification PDHs</td>
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<td>Prometric 9yr Recertification Exam (A&amp;B)s</td>
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<td>Supervisor Value Paks</td>
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<td>Supervisor Seminar Only</td>
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<tr>
<td>Supervisor Seminar &amp; 1 Part Retests</td>
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<td>Supervisor Seminar &amp; 2 Part Retests</td>
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<td><strong>CERTIFIED WELDING SALE REPRESENTATIVE (CWSR)</strong></td>
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<tr>
<td>Prometric Examss</td>
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<tr>
<td>Prometric Retests</td>
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<tr>
<td>Renewal</td>
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<tr>
<td><strong>CERTIFIED WELDING ENGINEER (CWe)g</strong></td>
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<tr>
<td>Part 1 &amp; 2 Exam</td>
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<td>Part 3 &amp; 4 Exam</td>
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<td>Retest (per part)</td>
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<td>Renewal</td>
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<td><strong>CERTIFIED RESISTANCE WELDING TECHNICIAN (CRWT)</strong></td>
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<tr>
<td>CRWT 2-day Seminar</td>
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<tr>
<td>CRWT Exams</td>
</tr>
<tr>
<td>CRWT Seminar and Exam Packages</td>
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<tr>
<td>Recertification by Exams</td>
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<tr>
<td>Retest</td>
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<tr>
<td><strong>CERTIFIED ROBOTIC ARC WELDING (CRAW)</strong></td>
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<tr>
<td>Technician/Operator Recertification by Exam</td>
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<tr>
<td>Operator to Technician Upgrade</td>
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<td>Technician/Operator Renewal</td>
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<td>Technician/Operator Recertification by Exam</td>
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<td>Technician/Operator Recertification by PDH/CEUs</td>
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<td><strong>CERTIFIED WELDER (CW)</strong></td>
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<td>Certified Welder Application</td>
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<td>Maintenance of Welder Certification</td>
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<tr>
<td><strong>WELDER PERFORMANCE QUALIFIER ENDORSEMENT</strong></td>
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<tr>
<td>WPQ 2-day Seminar</td>
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<tr>
<td>WPQ Exam</td>
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<tr>
<td>WPQ Seminar and Exam Package</td>
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<td>WPQ Retest</td>
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**EDUCATION’S ONLINE COURSES**

| 2-Week Online CWI Seminar (incl. 3 year membership) | +Member  | $1,865 | **Non Member** | $2,120 * |
| Member $1,865 (+ $2,400 refundable deposit)       | **Non-member $2,120 (+ $2,400 refundable deposit) |
| 2-Week Online CWI Seminar Exam                     | +Member  | $2,585 | **Non Member** | $2,840 * |
| (incl. 3 year membership. Prices reflect a $60 seat fee per part (A or C) & $120 for ALL parts for Prometric Testing.) | **Member $2,585 (+ $2,400 refundable deposit) | **Non-member $2,840 (+ $2,400 refundable deposit) |
| 8-Week Online CWI Seminar (incl. 3 year membership) | +Member  | $1,865 | **Non Member** | $2,120 * |
| Member $1,865 (+ $2,400 refundable deposit)       | **Non-member $2,120 (+ $2,400 refundable deposit) |
| Science of Nondestructive Testing                  | +Member  | $175 | **Non Member** | $235 |
| Welding Sales Representative Seminar               | +Member  | $450 | **Non Member** | $600 |
| Destructive Testing                                 | +Member  | $300 | **Non Member** | $400 |
| AWS D1.1 Code Clinic                                | +Member  | $250 | **Non Member** | $300 |
| AWS D17.1 Code Clinic                               | +Member  | $120 | **Non Member** | $150 |
| API 1104 Code Clinic                                | +Member  | $250 | **Non Member** | $300 |
| Economics of Welding                                | +Member  | $450 | **Non Member** | $600 |
| Understanding Welding Symbols                       | +Member  | $300 | **Non Member** | $400 |
| Fabrication Math I                                  | +Member  | $385 | **Non Member** | $510 |
| Fabrication Math II                                 | +Member  | $370 | **Non Member** | $495 |
| Safety in Welding                                    | +Member  | $74 | **Non Member** | $99 |
| WPS/POR Explained                                    | +Member  | $120 | **Non Member** | $150 |
| Metallurgy I                                         | +Member  | $175 | **Non Member** | $235 |
| Metallurgy II                                        | +Member  | $175 | **Non Member** | $235 |
| Welding Fundamentals I                              | +Member  | $350 | **Non Member** | $470 |
| Welding Fundamentals II                             | +Member  | $210 | **Non Member** | $265 |
| Welding Fundamentals III                            | +Member  | $150 | **Non Member** | $180 |
| Welding Supervisor Package: 7 Online Courses        | +Member  | $995 | **Non Member** | $1,245 |
| CRWT 2-Day Seminar                                   | +Member  | $620 | **Non Member** | $830 |

* 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 reexamination endorsements. Contact the ATF for pricing.
P Prices reflect a $60 seat fee per part (A or C) and $120 for ALL parts for Prometric Testing.
^ Additional ATF fees will apply for the practical exam (part B). Prices reflect a $60 seat fee per part for Prometric initial and/or reexamination endorsements. Contact the ATF for pricing.
^ Price is for all endorsements except Structural Drawing Reading.

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.

[For a complete price list of our online courses please visit https://awo.aws.org/online-courses/ Some online courses can be combined with other certification programs.]
## Accreditation Programs for Companies

### ACCREDITED TEST FACILITY (ATF)
Accredited Test Facilities (ATFs) have met AWS facility, personnel and resource requirements to test welders and qualify them for their Certified Welder credential.

### Accredited Test Facility (ATF) Price Schedule*

<table>
<thead>
<tr>
<th>Service</th>
<th>North America</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INITIAL AUDIT FEES</strong></td>
<td></td>
<td></td>
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<tr>
<td>Document Review</td>
<td>$720</td>
<td>$720</td>
</tr>
<tr>
<td>Initial On-Site Audit**</td>
<td>$2,040</td>
<td>$840 ***</td>
</tr>
<tr>
<td>Total</td>
<td>$2,760</td>
<td>$1,560</td>
</tr>
<tr>
<td><strong>ADDITIONAL FACILITIES</strong></td>
<td></td>
<td></td>
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<tr>
<td>Document Review</td>
<td>$600</td>
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</tr>
<tr>
<td>Initial On-Site Audit**</td>
<td>$1,800</td>
<td>$600 ***</td>
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<tr>
<td>Total</td>
<td>$2,400</td>
<td>$1,200</td>
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<tr>
<td><strong>RE-AUDIT</strong></td>
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<tr>
<td>On-Site Audit**</td>
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<td>TBD ***</td>
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<tr>
<td><strong>YEARLY RENEWALS</strong></td>
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<tr>
<td>Annual 1st Year</td>
<td>$360</td>
<td>$480</td>
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<tr>
<td>Annual 2nd Year</td>
<td>$360</td>
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<tr>
<td><strong>RE-ACCREDITATION AUDIT FEE</strong></td>
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<tr>
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<tr>
<td>On-Site Audit**</td>
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<td>Total</td>
<td>$2,400</td>
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<tr>
<td><strong>MP/PT FEES</strong></td>
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<tr>
<td>On-Site Audit**</td>
<td>$1,100</td>
<td>TBD ***</td>
</tr>
</tbody>
</table>

* 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)
CERTIFICATION, ENDORSEMENT, AND ACCREDITATION PROGRAMS

APPROVED TESTING CENTER (ATC)
The 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 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.

Certified Welding Fabricator (CWF) Price Schedule*

<table>
<thead>
<tr>
<th>INITIAL AUDIT FEES</th>
<th>North America</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document Review</td>
<td>$720</td>
<td>$720</td>
</tr>
<tr>
<td>Initial On-Site Audit**</td>
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<td>$840 ***</td>
</tr>
<tr>
<td>Total</td>
<td>$2,760</td>
<td>$1,560</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDITIONAL FACILITIES</th>
<th>North America</th>
<th>International</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document Review</td>
<td>$600</td>
<td>$600</td>
</tr>
<tr>
<td>Initial On-Site Audit**</td>
<td>$1,800</td>
<td>$600 ***</td>
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<tr>
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<table>
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<tr>
<th>3rd YEAR RECERTIFICATION AUDIT FEE</th>
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<td>$600</td>
</tr>
<tr>
<td>On-Site Audit**</td>
<td>$1,800</td>
<td>$600 ***</td>
</tr>
<tr>
<td>Total</td>
<td>$2,400</td>
<td>$1,200</td>
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</table>

<table>
<thead>
<tr>
<th>AWS CERTIFICATION FOR AISC ACCREDITED FABRICATORS</th>
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<tbody>
<tr>
<td>Initial Application</td>
<td>$420</td>
<td>$480</td>
</tr>
<tr>
<td>Renewal Application (paid annually)</td>
<td>$140</td>
<td>$200</td>
</tr>
</tbody>
</table>

* 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)
HEY CWIS! INTERESTED IN EXPANDING YOUR PROFESSIONAL CREDENTIALS?

CWIs with elevated understanding and skills in specific welding codes are constantly in demand and usually are better compensated. AWS endorsements reflect your demonstrated additional knowledge, skill or ability and are added to your certification credentials.

New Endorsement for 2020: Welder Performance Qualification
The all-new AWS Welder Performance Qualification endorsement is a credential that assesses a candidate’s knowledge, skills, and abilities to conduct welder performance qualification tests. Not only does getting this endorsement add to your professional credentials and growth, it can earn you renewal PDHs and/or CEUs, too.

Show your boss or your clients your commitment to conducting welder qualification testing by earning this endorsement.

Learn more at aws.org/wpqe
Whether you’re new to welding or preparing for that next great-paying job, AWS Learning is your one-stop resource for welding education. Our comprehensive catalog of seminars, online courses, and other educational materials are specifically designed to help you achieve your welding career goals.

Visit [aws.org/ourcourses](http://aws.org/ourcourses) to schedule an online demonstration or to learn more about our programs.
INSTRUCTOR-LED SEMINAR PROGRAMS

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.

<table>
<thead>
<tr>
<th>Seminar Type</th>
<th>Member</th>
<th>Non Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERTIFIED WELDING INSPECTOR SEMINAR</td>
<td>$1,865</td>
<td>$2,120</td>
</tr>
<tr>
<td>CERTIFIED WELDING INSPECTOR SEMINAR &amp; EXAM</td>
<td>$2,585</td>
<td>$2,840</td>
</tr>
</tbody>
</table>

The 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.

CERTIFIED WELDING INSPECTOR PART B TRAINING | $930 | $1,025 |

PART B TRAINING & EXAM PACKAGE | $1,580 | $1,675 |

Earning the Certified Welding Inspector (CWI) credential is serious work and can have a significant impact on a CWI’s career. Some CWI candidates require more immersive preparation on the Part B practical application portion of the CWI exam. The session includes a full-length, timed practice examination to prepare candidates for the CWI practical exam. Length: Part B Training 3 days  | Part B Training & Exam 4 days

8-WEEK ONLINE CWI SEMINAR* | $1,865 | $2,120 |

The 8-Week Online CWI Seminar is designed to prepare participants for the 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.

2-WEEK ONLINE CWI SEMINAR* | $1,865 | $2,120 |

2-WEEK ONLINE CWI SEMINAR & EXAM* | $2,585 | $2,840 |

The 2-Week Online CWI Seminar is designed to prepare participants for the Certified Welding Inspector Exam from the comfort of their own homes. The course is similar to the 8-Week Online CWI Seminar; it’s just condensed into two weeks of four-hour online sessions hosted by 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.

CERTIFIED WELDING INSPECTOR 9-YEAR RECERTIFICATION SEMINAR | $1,740 | $1,995 |

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: 6 Days

*Plus $2,400 refundable deposit for replica rental
## INSTRUCTOR-LED SEMINAR PROGRAMS

<table>
<thead>
<tr>
<th>Seminar and Exam Details</th>
<th>Member</th>
<th>Non Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERTIFIED RESISTANCE WELDING TECHNICIAN SEMINAR</td>
<td>$620</td>
<td>$830</td>
</tr>
<tr>
<td>CERTIFIED RESISTANCE WELDING TECHNICIAN SEMINAR &amp; EXAM</td>
<td>$855</td>
<td>$1,140</td>
</tr>
<tr>
<td>The CRWT exam spans an array of principles, processes, metallurgy and machinery as presented in Standards AWS C1.5 and AWS QC20. This instructor-led course is an in-depth review of terminology, materials and techniques covered in these AWS resistance welding standards and has been designed to prepare those working in resistance welding operations for the CRWT exam. All students will have access to 16 online modules to get a head start on resistance welding fundamentals prior to attending the seminar.</td>
<td>2 Days</td>
<td></td>
</tr>
<tr>
<td>CERTIFIED RADIOGRAPHIC INTERPRETER SEMINAR</td>
<td>$1,675</td>
<td>$1,890</td>
</tr>
<tr>
<td>CERTIFIED RADIOGRAPHIC INTERPRETER SEMINAR &amp; EXAM</td>
<td>$1,833</td>
<td>$2,088</td>
</tr>
<tr>
<td>The 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.</td>
<td>5 Days</td>
<td></td>
</tr>
<tr>
<td>CERTIFIED WELDING SUPERVISOR SEMINAR</td>
<td>$1,313</td>
<td>$1,401</td>
</tr>
<tr>
<td>CERTIFIED WELDING SUPERVISOR SEMINAR &amp; EXAM</td>
<td>$1,784</td>
<td>$1,872</td>
</tr>
<tr>
<td>A good welding supervisor manages resources, improves productivity, and increases the bottom line. This course focuses on the knowledge a supervisor needs to support improvement of the welders’ environment, productivity, throughput, weld quality and safety.</td>
<td>5 Days</td>
<td></td>
</tr>
<tr>
<td>WELDER PERFORMANCE QUALIFIER ENDORSEMENT SEMINAR 2-DAY</td>
<td>$620</td>
<td>$705</td>
</tr>
<tr>
<td>WELDER PERFORMANCE QUALIFIER ENDORSEMENT SEMINAR 2-DAY &amp; EXAM</td>
<td>$940</td>
<td>$1,025</td>
</tr>
<tr>
<td>This seminar offers an in-depth review of qualifier responsibilities, requirements for test facilities, equipment and materials, and how to prepare Procedure Qualification Records (PQRs) and other integral documents. The seminar concludes with a full-length practice exam and a detailed, instructor-led review of each question and answer in order to better prepare attendees for test day.</td>
<td></td>
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</tr>
</tbody>
</table>

### ON-LOCATION CUSTOM TRAINING/EXAM PREP

AWS brings instructors to your location. Build your staff’s skill sets, prepare them for their certification exam and ensure that they meet AWS qualifications, while eliminating travel costs and allowing you to control schedules. Duration and rates: TBD upon consultation with AWS.
<table>
<thead>
<tr>
<th>ONLINE COURSES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CERTIFIED WELDING INSPECTOR PRE-SEMINAR</strong></td>
</tr>
<tr>
<td>This self-paced, interactive series of courses is designed to prepare participants for the Instructor-led CWI Seminar and Part A (Fundamentals) of the CWI Exam. The seminar includes Welding Fundamentals I, Welding Fundamentals II, Welding Fundamentals III, Nondestructive Testing, Destructive Testing, Understanding Welding Symbols, Fabrication Math II, Metallurgy II, WPS/PQR Explained, and Safety in Welding.</td>
</tr>
<tr>
<td><strong>WELDING SUPERVISOR SEMINAR</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>WELDING SALES REPRESENTATIVE SEMINAR</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>WELDING FUNDAMENTALS I</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>WELDING FUNDAMENTALS II</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>WELDING FUNDAMENTALS III</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>SAFETY IN WELDING</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

*Approximate Hours | Professional Development Hours | Continuing Education Units

*Access to the 3 PDHs / 0.3 CEUs and Certificate of Completion requires a $74 / $99 payment.
## ONLINE COURSES

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Member</th>
<th>Non Member</th>
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</thead>
<tbody>
<tr>
<td><strong>FABRICATION MATH I</strong></td>
<td>$385</td>
<td>$510</td>
</tr>
<tr>
<td>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.</td>
<td></td>
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</tr>
<tr>
<td>18 Hours</td>
<td>18 PDHs</td>
<td>1.8 CEUs</td>
</tr>
<tr>
<td><strong>FABRICATION MATH II</strong></td>
<td>$370</td>
<td>$495</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Hours</td>
<td>15 PDHs</td>
<td>1.5 CEUs</td>
</tr>
<tr>
<td><strong>UNDERSTANDING WELDING SYMBOLS</strong></td>
<td>$300</td>
<td>$400</td>
</tr>
<tr>
<td>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.</td>
<td></td>
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</tr>
<tr>
<td>10 Hours</td>
<td>10 PDHs</td>
<td>1 CEUs</td>
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<tr>
<td><strong>METALLURGY I</strong></td>
<td>$175</td>
<td>$235</td>
</tr>
<tr>
<td>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.</td>
<td></td>
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<tr>
<td>6 Hours</td>
<td>6 PDHs</td>
<td>0.6 CEUs</td>
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<tr>
<td><strong>METALLURGY II</strong></td>
<td>$175</td>
<td>$235</td>
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<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Hours</td>
<td>6 PDHs</td>
<td>0.6 CEUs</td>
</tr>
<tr>
<td><strong>THE SCIENCE OF NONDESTRUCTIVE TESTING</strong></td>
<td>$175</td>
<td>$235</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Hours</td>
<td>6 PDHs</td>
<td>0.6 CEUs</td>
</tr>
<tr>
<td><strong>DESTRUCTIVE TESTING</strong></td>
<td>$300</td>
<td>$400</td>
</tr>
<tr>
<td>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.</td>
<td></td>
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</tr>
<tr>
<td>7 Hours</td>
<td>7 PDHs</td>
<td>1 CEUs</td>
</tr>
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</table>

[Approximate Hours | Professional Development Hours | Continuing Education Units]
ONLINE COURSES

ECONOMICS OF WELDING
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.

<table>
<thead>
<tr>
<th>Hours</th>
<th>PDHs</th>
<th>CEUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>18</td>
<td>1.8</td>
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</tbody>
</table>

Member: $450  Non Member: $600

WPS/PQR EXPLAINED
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.

<table>
<thead>
<tr>
<th>Hours</th>
<th>PDHs</th>
<th>CEUs</th>
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<tbody>
<tr>
<td>4</td>
<td>4</td>
<td>0.4</td>
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</tbody>
</table>

Member: $120  Non Member: $150

INSTRUCTIONAL STRATEGIES FOR WELDING EDUCATORS
The course is ideal for novice or experienced welding instructors looking to develop a stronger teaching foundation, develop more effective curriculum, and incorporate pedagogical best practices in the classroom and welding lab. This series of brief, interactive modules, each with corresponding knowledge checks, case studies, and assessments, was developed in partnership with Weld-Ed and delivered by Dr. W. Richard Polanin, a lifelong welding educator and industry professional, as well as current AWS Vice President and incoming AWS President (2021).

<table>
<thead>
<tr>
<th>Hours</th>
<th>PDHs</th>
<th>CEUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>1.0</td>
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</tbody>
</table>

Member: $150  Non Member: $175

ONLINE CODE CLINICS
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
This comprehensive 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.

<table>
<thead>
<tr>
<th>Hours</th>
<th>PDHs</th>
<th>CEUs</th>
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<tbody>
<tr>
<td>4</td>
<td>4</td>
<td>0.4</td>
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</tbody>
</table>

Member: $250  Non Member: $300

API 1104 ONLINE CODE CLINIC
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.

<table>
<thead>
<tr>
<th>Hours</th>
<th>PDHs</th>
<th>CEUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Member: $250  Non Member: $300

D17.1 ONLINE CODE CLINIC
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.

<table>
<thead>
<tr>
<th>Hours</th>
<th>PDHs</th>
<th>CEUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Member: $120  Non Member: $150

Visit aws.org/ourcourses to schedule an online demonstration or to learn more about our programs.
INDUSTRY PARTNER COURSES

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 $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
☐ 1 Hour

PRINCIPLES OF METALLURGY $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.
☐ 5 Hours

HARDNESS TESTING $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.
☐ 1/2 Hour

STEEL METALLURGY $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
☐ 3 Hours

STEEL CASE HARDENING $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
☐ 1 Hour

☐ Approximate Hours
INDUSTRY PARTNER COURSES

STEEL THROUGH HARDENING $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
1 Hour

TENSILE TESTING $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.
1/2 Hour

Non Destructive Testing Classroom
Learn from the experts including industry legends Chuck Hollier and Jim Treat. The NDT classroom offers the most comprehensive online training programs available today.

INTRODUCTION TO NDT $525
This course is ideal for those who would like a thorough overview of the major methods. Emphasis is placed on benefits, limitations, and applications 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).
5 Hours

EDDY CURRENT I $1,045
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 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.
20 Hours

EDDY CURRENT II $1,045
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.
20 Hours

☐ Approximate Hours
INDUSTRY PARTNER COURSES

VISUAL TESTING I & II
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 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.

12 Hours

$725

PENETRANT TESTING I & II
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. PT materials, equipment, variables, techniques, and evaluation of test results are presented and demonstrated along with a description of widely used applications.

14.5 Hours

$835

MAGNETIC PARTICLE TESTING I & II
This course combines the Level I and II subjects, 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.

11 Hours

$835

RADIOGRAPHY TESTING I
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 emphasizes the essentials of radiation safety. It is also appropriate for other personnel who require a basic understanding of the basics of radiographic testing.

22 Hours

$725

RADIOGRAPHY TESTING II
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 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.

22 Hours

$945

RADIATION SAFETY COURSE
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. 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.

28 Hours

$1,045

Approximate Hours
ULTRASONIC TESTING I

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. 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.

26 Hours

ULTRASONIC TESTING II

Ultrasonic Testing II 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 is also beneficial for those preparing to take Level III examinations.

26 Hours

ULTRASONIC THICKNESS TESTING

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.

14 Hours

Visit aws.org/ourcourses to schedule an online demonstration or to learn more about our programs.

FUNDAMENTALS OF WELDING CURRICULUM

Instructors are busy. That’s why we’ve done some of the work for you. With over 100 lesson plans and a robust suite of digital and print resources, you can focus on what matters most: your students.

The AWS Fundamentals of Welding Curriculum is a newly-created collection of educational resources and learning tools designed by leading industry education professionals to help you effectively deliver quality instruction.

FUNDAMENTALS OF WELDING CURRICULUM

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  - Featuring 100+ guided laboratory activities
- Classroom posters
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  - 4 decorative

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Instructor Resources

- 100+ detailed lesson plans
- 12 extensive PowerPoint slide decks
- Handouts, student assessments, and checklists
- Standards and supplemental documents including:
  - SWPSs

Learn more at aws.org/curriculum

Approximate Hours
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 fee for Levels I and II combined**

- $600

**One-time upgrade registration fee from Level I to Level II**

- $100

The AWS SENSE program is designed to offer students a pathway to achieve welding certification. 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
ONLINE EDUCATIONAL LIBRARY

The Online Educational Library is designed to meet the needs of today’s welding students and instructors. Developed by AWS subject matter experts and learning professionals, our 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 Learning Management System to assign tasks and track student progress.

A COMPLETE SOLUTION DESIGNED FOR WELDING EDUCATORS

- **24/7 Access** to your courses and records from any device with an internet connection.
- **Practice Quizzes** allow students to measure content retention and comprehension.
- **Learning Management System** allows instructors to view tests and quizzes, and track student progress.
- **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 through out 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.
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ONLINE EDUCATIONAL LIBRARY

The Online Educational Library complements existing welding education programs and provides over 110 hours of welding instruction throughout 13 comprehensive courses, including:

- 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

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The Online Educational Library is affordably priced on a sliding scale based on institution type. Annual subscriptions include any new courses that are added to enhance the Library.

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COLLEGE**  $7,000
All courses  |  Unlimited users  |  Single campus location

UNIVERSITY***  $9,000
All courses  |  Unlimited users  |  Single campus location

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MINIMUM SPENDING COMMITMENT  $3,000
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* Associates is highest degree offered
** Bachelors is highest degree offered
*** Masters and/or Doctorate are highest degree offered
2020

QUALIFICATION OF WELDING PROCEDURES
October 7-8   | Virtual Event

ALUMINUM VIRTUAL CONFERENCE
October 20-21   | Virtual Event

2021

INTERNATION BRAZING AND SOLDERING
April 25-28   | Denver, CO

ADVANCES IN WELDING AND ADDITIVE MANUFACTURING RESEARCH
August 8-13   | Miami, FL

Learn more at awo.aws.org/conferences/upcoming-conferences/.
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AWS member benefits are designed to support the growth of both the industry and the people who work in it. This year, make AWS work as hard as you do to advance your career, connect to our deep technical knowledge base and save on AWS products and services.
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The 2-Week Online CWI Seminar is 10 interactive, four-hour sessions hosted live by an AWS instructor. New sessions start regularly. For more information, visit https://awo.aws.org/online-courses/

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MEMBERSHIP PROGRAMS

INDIVIDUAL MEMBERSHIP
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; and more.

WELDER MEMBERSHIP
Take advantage of specialized membership benefits geared towards welders. Gain access to courses, seminars, certifications and other resources; 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 Institution, and Welding Distributor.

SUSTAINING COMPANY
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
Designed to help your mid-size company boost productivity, solve production problems; improve competitiveness and offer valuable benefits to your employees.

AFFILIATE COMPANY
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.

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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
Designed to provide you with valuable industry exposure and connections to increase your sales and market share.

STUDENT MEMBERSHIP
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.
# Certification

**QC1:2016, Standard for AWS Certification of Welding Inspectors**

The Certified Welding Inspector (CWI) program identifies proven professionals who improve product quality through early detection of flaws and defects.

- 12 pages
  - Order Code: QC1
  - Member: $12
  - Non Member: $16

**QC4-89, Standard for Accreditation of Test Facilities for AWS Certified Welder Program**

- 12 pages
  - Order Code: QC4
  - Member: $12
  - Non Member: $16

**QC5-91, Standard for Certification of Welding Educators**

- 10 Pages
  - Order Code: QC5
  - Member: $12
  - Non Member: $16

**QC7-93, Standard for AWS Certified Welders**

- 10 Pages
  - Order Code: QC7
  - Member: $12
  - Non Member: $16

**QC7-93 Supplement C, Welder Performance Qualification Sheet Metal Test Requirements**

- 38 Pages
  - Order Code: QC7C
  - Member: $12
  - Non Member: $16

**QC7-93 Supplement F, Chemical Plant and Petroleum Refinery Piping**

- 22 Pages
  - Order Code: QC7F
  - Member: $12
  - Non Member: $16

**QC7-93 Supplement G, AWS Performance Qualification Test**

- 10 Pages
  - Order Code: QC7G
  - Member: $12
  - Non Member: $16

**QC10:2017, Specification for Qualification and Certification of SENSE Level I-Entry Welders**

- 34 Pages. Description & preview online.
  - Order Code: QC10
  - Member: $24
  - Non Member: $32

**QC11:2017, Specification for Qualification of Certification of SENSE Level II-Advanced Welders**

- 38 Pages. Description & preview online.
  - Order Code: QC11
  - Member: $27
  - Non Member: $36

**QC13:2006, Specification for the Certification of Welding Supervisors**

- 16 Pages
  - Order Code: QC13
  - Member: $12
  - Non Member: $16

**QC14:2009, Specification for the Certification of Welding Sales Representatives**

- 16 Pages
  - Order Code: QC14
  - Member: $12
  - Non Member: $16

**QC15:2008-AMD1, Specification for the Certification of Radiographic Interpreters**

- 16 Pages
  - Order Code: QC15
  - Member: $12
  - Non Member: $16

\[ Total \text{ Pages} \]
PROFESSIONAL AND CAREER DEVELOPMENT RESOURCES

PUBLICATIONS & RESOURCES

QC17:2015, Specification for AWS Accreditation of Certified Welding Fabricators
 pä 14 Pages
Order Code: QC17
Member  Non Member
$12  $16

 pä 24 Pages
Order Code: QC19
Member  Non Member
$12  $16

QC20:2020, Specification for AWS Certification of Resistance Welding Technicians
 pä 22 Pages
Order Code: QC20
Member  Non Member
$12  $16

see page 37

CM:2000, Certification Manual for Welding Inspectors
see page 37

Certified Welding Inspector Pre-Seminar
This self-paced interactive online program combines Welding Fundamentals I, Nondestructive Testing, Understanding Welding Symbols, Fabrication Math II, Metallurgy II, WPS/PQR Explained, and Economics of Welding into a single package to prepare CWI candidates for the AWS CWI seminar and Part A (Fundamentals) of the examination.
ä 72 Hours
Register at aws.org/ourcourses
If purchased with a CWI Instructor-Lead Seminar
Member  Non Member
$750  $750

Welding Sales Representative Seminar
A detailed examination of the technical aspect of welding and welding equipment as they relate to sales, distribution and manufacturing. Focuses on safety in welding, cutting and allied processes, the fundamental principles of welding operations and processes, basic arc equipment, shielding gases, consumables, and related components. Presented in 13 interactive and engaging modules, this seminar is perfect for both inside and outside salespeople, distributors, manufactures, supervisors, managers, and any other professional that wants to gain a technical understanding of welding principles, methodology, equipment, consumables, and variables.
ä 23 Hours
Register at aws.org/ourcourses
Member  Non Member
$450  $600

The following certification documents are available for FREE Download at aws.org/ourcourses
Printed copy prices are included below.

Order Code: QC1  $12  $16
Order Code: QC4  $12  $16
Order Code: QC5  $12  $16
Order Code: QC7  $12  $16
Order Code: QC7C  $12  $16
Order Code: QC7F  $12  $16
Order Code: QC7G  $12  $16
Order Code: QC13  $12  $16
Order Code: QC14  $12  $16
Order Code: QC15  $12  $16
Order Code: QC17  $12  $16
Order Code: QC19  $12  $16
Order Code: QC20  $12  $16
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**
  - Spanish Edition (2009) $90 $120

**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**
  - Spanish Edition (2000) $90 $120

**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.

- Order Code: **B4.0**

**B4.0M:2000 (R2010)**
Metric only. 120 pages, 64 figures (Reaffirmed 2010).

- Order Code: **B4.0M**
  - $78 $104

**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, fourth edition.

- Order Code: **WI**

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

**C3.2M/C3.2:2019, 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 71

**G1.10M:2016, Guide for the Evaluation of Thermoplastic Welds** see page 71

**APG-DISC – 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

- Order Code: **APG-DISC**
  - $21 $28
10-Piece Toolkit
The tools to start your inspection career are now available in a heavy-duty vinyl case. These are the same tools used in the AWS hands-on Certified Welding Inspector Test.

Quality training kit contains:
- 7 Piece Fillet Weld Set
- V-WAC Gauge
- Inspection Mirror
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Qualification

Includes addenda. Covers all fusion welding processes and an exhaustive array of materials used in metal fabrication. Specifies requirements for the qualification of welding procedures, and for performance qualification of welders and welding operators for manual, semiautomatic, mechanized, and automatic welding. 326 pages.

Welding processes include:
- Oxyfuel Gas Welding
- Submerged Arc Welding
- Flux Cored Arc Welding
- Electrogas Welding
- Shielded Metal Arc Welding
- Laser Beam Welding
- Plasma Arc Welding
- Electroslag Welding
- Gas Tungsten Arc Welding
- Gas Metal Arc Welding
- Stud Arc Welding

B2.1 gives a complete coverage of:
- Base Metals
- Filler Metals
- Qualification Variables
- Testing Requirements

Order Code: B2.1


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Hard Copy Order Code: B2.1-BMG $66 $88

Specifies requirements for qualification of brazing procedure specifications, and for performance qualification of brazers and brazing operators for manual, mechanized, and automatic brazing. 84 pages, 9 tables, 16 figures, 3 forms.

Order Code: B2.2 $66 $88

This specification provides the requirements for qualification of soldering procedure specifications, solderers, and soldering operators for manual, mechanized, and automatic soldering. The soldering processes included are torch soldering, furnace soldering, induction soldering, resistance soldering, dip soldering, iron soldering, and infrared soldering. Base metals, soldering filler metals, soldering fluxes, soldering atmospheres, and soldering joint clearances are also included. 78 pages.

Order Code: B2.3 $69 $92
B2.4:2012, Specification for Welding Procedure and Performance Qualification for Thermoplastics
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.
Order Code: B2.4

B5.1:2013-AMD1, Specification for the Qualification of Welding Inspectors
Defines qualification requirements for welding inspectors, including experience, satisfactory completion of an examination, and proof of visual acuity. 22 pages.
FREE Download at aws.org/ourcourses
Hard Copy Order Code: B5.1

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
Order Code: B5.2

B5.4:2005, Specification for the Qualification of Welder Test Facilities
Details qualification methods and test facility and assessment requirements including personnel, organization, procedures, equipment, and capability. Includes a non-mandatory annex covering qualification of assessors. 22 pages, 6 chapters, 4 annexes.
FREE Download at aws.org/ourcourses
Hard Copy Order Code: B5.4

B5.5:2011, Specification for the Qualification of Welding Educators
This specification defines the requirements and program to qualify Welding Educators. The qualification of a Welding Educator is determined by a combination of education and experience, satisfactory demonstration of welding performance qualification tests, and written and practical examinations. The written examination demonstrates the educator’s knowledge of welding processes, weld discontinuities, destructive and nondestructive test methods, safety, welding metallurgy, weld symbols, basic arithmetic, codes, and other standards.
Order Code: B5.5

B5.9:2006, Specification for the Qualification of Welding Supervisors
This standard describes the requirements for qualification as a Welding Supervisor and Senior Welding Supervisor. The requirements include education, experience, and a written examination. This standard also covers the levels of qualification and the job functions a qualified Welding Supervisor should be able to perform. ANSI Approved. 18 pages.
FREE Download at aws.org/ourcourses
Hard Copy Order Code: B5.9

B5.14:2009, Specification for the Qualification of Welding Sales Representatives
Establishes the minimum requirements to qualify as a Welding Sales Representative. This qualification is based on the individual’s education and experience, and his or her ability to pass an examination. 16 pages, 1 table.
Order Code: B5.14
B5.15:2010, Specification for the Qualification of Radiographic Interpreters
Defines requirements for qualification of radiographic interpreters, including experience, knowledge, and skills unique to interpretation of radiographic media and determination of acceptance criteria for weldments and adjacent base metal. Now provides examination subjects and weights. 24 pages.
   FREE Download at aws.org/ourcourses
   Hard Copy Order Code: B5.15 $48 $64

B5.16:2006, Specification for the Qualification of Welding Engineers
This specification establishes the requirements for qualification of Welding Engineers employed in the welding industry. The minimum experience, examination, application, qualification, and requalification requirements and methods are defined herein. This specification is a method for engineers to establish a record of their qualification and abilities in welding industry work such as development of procedures, processes controls, quality standards, problem solving, etc. 20 pages.
   FREE Download at aws.org/ourcourses
   Hard Copy Order Code: B5.16 $48 $64

B5.17:2014, Specification for the Qualification of Welding Fabricators
Establishes minimum requirements necessary to qualify as a welding fabricator, based on an examination of the implementation of the fabricator’s quality manual to verify compliance to defined requirements. Also defines the welding fabricator’s functions and lists the minimum reference materials that should be possessed. 22 pages.
   FREE Download at aws.org/ourcourses
   Hard Copy Order Code: B5.17 $51 $68

C1.5:2019, Specification for the Qualification of Resistance Welding Technicians
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, 2 annexes.
   Order Code: C1.5 $56 $74

C2.16/C2.16M:2017, Guide for Thermal Spray Operator Qualification Programs
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.
   Order Code: C2.16 $53 $71

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.
   Order Code: C7.4 $57 $76

C7.6/C7.6M:2017, Process Specification and Operator Qualification for Laser Hybrid Welding
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.
   Order Code: C7.6 $57 $76
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.
Order Code: D16.4

$48 $64

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.
Order Code: EG2.0

$57 $76

ELW Set A (EG2.0:2017, EG2.0 Supplement, and QC10:2017)
Order Code: ELW-SETA

$122 $163

EG2.0:2017, *Supplement Guide to the Training of Welding Personnel; Level I—Entry Welder*
The goal of this supplement is to improve welder training by using and teaching the application of AWS Standard Welding Procedure Specifications (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.
Order Code: EG2.0 Supp

$63 $84

EG3.0:2017, *Guide for the Training of Welding Personnel; SENSE Level II—Advanced Welder*
A competency-based curriculum guideline detailing the minimum acceptable skill requirements for training and qualifying advanced welders. 168 pages.
Order Code: EG3.0

$39 $52

Order Code: ELW-SETB

$138 $184

The goal of this supplement is to improve welder training by using and teaching the application of AWS Standard Welding Procedure Specifications (SWPSs) related to the SENSE Level II—Advanced Welder workmanship and performance qualification tests.
Order Code: EG3.0 Supp

$93 $124

G1.6:2006, *Specification for the Qualification of Plastics Welding Inspectors for Hot Gas, Hot Gas Extrusion, and Heated Tool Butt Thermoplastic Welds*
Defines the qualification requirements for plastics welding inspectors. 22 pages.
Order Code: G1.6

$48 $64
Best Practices for Performing a Welder Qualification Test
The purpose of this technical manual is to define the best practices for qualification testing of welders. This manual is designed as a high-level reference guide, meaning it is purposely generic in order to facilitate qualification testing done to a variety of qualification standards and influenced by the needs of employers and individual welders. Due to the generic nature of this manual, the qualifier (person administering the test) cannot rely only on this content when conducting welder qualification testing. This manual is a crucial tool, but qualified will also need the applicable qualification standard and a WPS appropriate for the test being conducted, as well as any other resources relevant to the process.

This manual is divided into sections based on the three phases of welder performance qualification testing: Pre-Test Investigation, Conducting the Test, and Post-Test Activities. Further resources are included in the appendices, including sample documents the qualifier is encouraged to customize to their own needs and integrate into their regular procedures.

Order Code: BPWQ $57 $76

Training

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.

Order Code: CM $150 $200
Spanish Edition (2000) $64 $64

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.

Order Code: CMWS $150 $200

Defines the physical requirements of a welding instruction facility. Intended to give step-by-step guidance to institutions that want to build or convert facilities for welder training. 20 pages.

Order Code: GWF $48 $64

Official textbook for CWI preparatory seminar. Helps CWI candidates prepare for the open-book portion of the CWI examination, which tests ability to navigate through a code and find correct answers within a specified time. Includes practice questions similar to the exam questions, and the answers.

Order Code: CCRM $66 $88
Study Guide for API Standard 1104
Official textbook for CWI preparatory seminar. Helps CWI candidates prepare for the open-book portion of the CWI examination, which tests ability to navigate through the 21st edition of the API 1104 code and find correct answers within a specified time. Includes test questions similar to the exam questions, and the answers. 104 pages, 2 tables, 8 figures.
Order Code: API-M $66 $88

Weld Replicas
These are 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-one experience.
Bend Test Replica Order Code: BTR $600 $600
Groove Weld Plate (A) Replica Order Code: GWPR-A $350 $350
Groove Weld Plate (B) Replica Order Code: GWPR-B $350 $350
Pipe Replica Order Code: PR $850 $850
T-Joint Replica Order Code: TJR $600 $600

Replica Welding Set
The complete, five-piece set of replicas. Includes Bend Test, Groove Weld Plates (A) & (B), Pipe and T-Joint Replicas.
Order Code: RWS $2,400 $2,400

10-Piece Toolkit
The tools to start your inspection career are now available in a heavy-duty vinyl case. These are the same tools used in the AWS hands-on Certified Welding Inspector Test.
Quality training kit contains:
* 7 Piece Fillet Weld Set  * V-WAC Gauge  * Inspection Mirror
* Hi-Lo Gauge  * Protractor  * C4.1 Gauge  * Weld Profile Gauge
Standard Unit Order Code: 10KIT $270 $360
Metric Unit Order Code: 10KITM $270 $360

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 $222 $296
Chinese Edition (2008) $95 $95
Spanish Edition (2000) $95 $95

WIT-W:2008, Welding Inspection Technology Workbook
A companion to Welding Inspection Technology. This publication includes practice questions. 83 pages.
Order Code: WIT-W $63 $84

RIT-T:2016, Radiographic Interpretation Textbook
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.
Order Code: RIT-T $123 $164

Welding Fundamentals
Presented in short easy-to-understand online modules, this self-paced online course provides a comprehensive overview of the basic principles of welding. see page 16

Fabrication Math Levels I and II
Makes each mathematical concept easy to understand. Practical exercises allow welders, welding students, supervisors and inspectors to apply basic math skills to various aspects of the welding process. see page 17
The FABTECH family of events are the premier shows dedicated to welding, metal forming, fabricating, and finishing technologies. FABTECH provides a convenient ‘one-stop shop’ venue where you can meet with worldclass suppliers, see the latest industry products and developments, and find the tools to improve productivity, increase profits and discover new solutions to all your metal forming, fabricating, welding and finishing needs. FABTECH events are held in the USA, Mexico, and Canada.

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September 13-16, 2021  
McCormick Place  |  Chicago, IL

Attendee admission: **Free if registered by 09/10**

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### FABTECH Mexico

May 4-6, 2021  
Monterrey, Mexico

Attendee admission: **Free**

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### FABTECH Canada

June 14-16, 2022  
Toronto, Canada

Attendee admission: **Free**

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YOUR SOURCE FOR 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, including standards, reference materials, periodicals, and instructional videos. Additionally, the Digital Library includes a wide range of journals from across the web that have been indexed and made discoverable in the platform.

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

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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 that 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 web. Generally hard to find titles that contain important discoveries and prior art and now accessible through the periodicals package.
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- 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.

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- No additional fees for access to archives of the AWS periodicals.
- Subscriptions can be started at the beginning of any month, adhering to the schedule and budget cycle of the academic institution.
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Other Special Pricing Situations:

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

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**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.

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Contact 1-800-798-9296 or submit and email to: aws@madcad.com. For additional information and to create a free trial account to review the Library’s features please refer to the following link: AWSDL.madcad.com.
AWS NOW DELIVERS 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
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- Execution of Steel Structures
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- 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
- Testing and Inspection of Welds
- Welding and Brazing in Aerospace
- Welding Consumables
- Welding Simulation
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  $60   $80

A2.1:2020, 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.

Wall Chart (22" x 38") Order Code: A2.1-WC  $33   $44
Desk Chart (11" x 17") Order Code: A2.1-DC  $27   $36
Buy Both Charts, SAVE 10% Order Code: A2.1-WC & DC  $57   $76
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A2.4:2020 (Book) and A2.1:2020-WC & DC (Charts) Order Code: A2.4/A2.1 SET  $174   $232
Larger Wall Chart (36" x 27") Order Code: A2.1-WCXL  $36   $48

A2.4:2020, 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  $129   $172
Spanish Edition (2020)  $57   $57

A3.0M/A3.0:2020, Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying
Alphabetical glossary of over 1,500 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  $150   $200
Spanish Edition (2020)  $51   $68

A3.1:2020, Master Chart of Welding and Joining Processes
24” by 30” chart extracted from A3.0
Order Code: A3.1  $33   $44

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 or 8” x 10” best copy available, 18th edition.

Order Code (Book): JWE  $135   $180
Order Code (CD): JWE CD  $135   $180

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  $114   $152
### 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**

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### 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**

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### 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**

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### 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**

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### 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**

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### 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**

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### Welding Replica Set with Pelican Case

Order Code: **RWK-A-Case**

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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 [aws.org/health](http://aws.org/health) or purchase the printed document.

**Order Code:** Z49.1
- $57


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
- $51

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
- $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.

**Order Code:** F1.3
- $51

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
- $48

F2.2:2001 (R2019), *Lens Shade Selector*
11” x 17” chart (Reaffirmed 2010).

**Order Code:** F2.2
- $30
F2.3M:2011 (R2019), Specification for Use and Performance of Transparent Welding Curtains and Screens
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
Member price: $48 | Non Member price: $64

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
Member price: $60 | Non Member price: $80

F4.1:2017, Safe Practices for the Preparation of Containers and Piping for Welding, Cutting, and Allied Processes
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
Member price: $48 | Non Member price: $64

F4.2:2020, Safety Guidelines for Proper Selection of Welding Cables
Order Code: F4.2
Member price: $48 | Non Member price: $64

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 a FREE PDF at aws.org/health or purchase the printed document.

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<th>Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940-1977</td>
<td>144</td>
<td>EWH-1</td>
</tr>
<tr>
<td>1978-1979</td>
<td>70</td>
<td>EWH-2</td>
</tr>
<tr>
<td>1979-1980</td>
<td>44</td>
<td>EWH-3</td>
</tr>
<tr>
<td>1980-1982</td>
<td>58</td>
<td>EWH-4</td>
</tr>
<tr>
<td>1982-1984</td>
<td>52</td>
<td>EWH-5</td>
</tr>
<tr>
<td>1984-1985</td>
<td>6</td>
<td>EWH-6</td>
</tr>
<tr>
<td>1986-1987</td>
<td>68</td>
<td>EWH-7</td>
</tr>
<tr>
<td>1988-1989</td>
<td>62</td>
<td>EWH-8</td>
</tr>
<tr>
<td>1990-1991</td>
<td>78</td>
<td>EWH-9</td>
</tr>
<tr>
<td>1992-1994</td>
<td>100</td>
<td>EWH-10</td>
</tr>
<tr>
<td>1995-1996</td>
<td>79</td>
<td>EWH-11</td>
</tr>
<tr>
<td>1997-1999</td>
<td>103</td>
<td>EWH-12</td>
</tr>
<tr>
<td>2000-2002</td>
<td>86</td>
<td>EWH-13</td>
</tr>
<tr>
<td>2002-2005</td>
<td>106</td>
<td>EWH-14</td>
</tr>
</tbody>
</table>
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C4.2/C4.2M:2017, Recommended Practices for Oxyfuel Gas Cutting Torch Operation
see page 63

see page 63

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 16
Development and qualification of welding procedures can be time-consuming and expensive.

### SHEET METAL

<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>10-18 gauge</td>
<td>GMAW-S</td>
<td>ER70S-6</td>
<td>As-welded, with or w/o backing</td>
<td>B2.1-1-004:2002(R2013)</td>
</tr>
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<td>GTAW</td>
<td>ER70S-2 or -3</td>
<td>As-welded, with or w/o backing</td>
<td>B2.1-1-008:2002(R2013)</td>
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<td>B2.1-1-012:2002(R2013)</td>
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<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>
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<td>B2.1-1-006:2002(R2013)</td>
</tr>
<tr>
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<td>B2.1-1-010:2015</td>
</tr>
<tr>
<td>Carbon to Stainless</td>
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<td>SMAW</td>
<td>E309-15,-16 or -17</td>
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<td>B2.1-1-014:2002(R2013)</td>
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<td>ER3XX</td>
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<td>B2.1-8-005:2002(R2013)</td>
</tr>
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<td>B2.1-8-009:2002(R2013)</td>
</tr>
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<td>SMAW</td>
<td>E3XX-15,-16 or -17</td>
<td>As-welded, with or 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 or w/o backing</td>
<td>B2.1-22-015:2011</td>
</tr>
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</table>

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

<table>
<thead>
<tr>
<th>Base Metal</th>
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<td>Carbon Steel</td>
<td>3/16&quot; – 7/8&quot;</td>
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<td>1/8&quot; – 1-1/2&quot;</td>
<td>GTAW f/b SMAW</td>
<td>ER70S-2 &amp; E7018</td>
<td>As-welded or PWHT</td>
<td>B2.1-1-021:2018</td>
</tr>
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<td>As-welded or PWHT</td>
<td>B2.1-1-017:2018</td>
</tr>
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<td>As-welded or PWHT</td>
<td>B2.1-1-022:2018</td>
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<td>As-welded or PWHT</td>
<td>B2.1-1-026:2018</td>
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<td>E71T-11</td>
<td>As-welded</td>
<td>B2.1-1-027:2018</td>
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<td>FCAW-G, C02 gas shielded</td>
<td>E70T-1 or E71T-1</td>
<td>As-welded</td>
<td>B2.1-1-019:2018</td>
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<td>E70T-1 or E71T-1</td>
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<td>B2.1-1-020:2018</td>
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<td>ER3XX &amp; E3XX-XX</td>
<td>As-welded</td>
<td>B2.1-8-025:2001(R2012)</td>
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<td>E3XX-XX</td>
<td>As-welded</td>
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</tr>
</tbody>
</table>

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

AWS publishes Standard Welding Procedure Specifications (SWPSs), which are reviewed and validated by the Welding Procedures Committee of the Welding Research Council. They are balloted through the AWS standards-development program as American National Standards. Standard Welding Procedure Specifications may be used on work covered by the AWS D1.1, Structural Welding Code—Steel with the engineer’s approval. The National Board Inspection Code has adopted all pipe SWPSs except B2.1-1-202 and pipe procedures for Naval Applications. SWPSs with red order numbers may be used on ASME Boiler and Pressure Vessel work with additional requirements spelled out in Section IX of ASME Boiler & Pressure Vessel Code. All licenses are good for unlimited intra-company applications.
<table>
<thead>
<tr>
<th>Material Type</th>
<th>Thickness</th>
<th>Welding Process</th>
<th>Welding Consumables</th>
<th>Reference Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel</td>
<td>1/8&quot; – 1-1/2&quot;</td>
<td>GTAW consumable inserts</td>
<td>In309 and ER309(L)</td>
<td>B2.1-8-231:2002-AMD1 (R2013)</td>
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<td>B2.1-8-229:2002-AMD1 (R2013)</td>
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<td>E309(L)-15, or -16</td>
<td>B2.1-8-228:2002 (R2012)</td>
</tr>
</tbody>
</table>

**Note:** FCAW limited to uphill progression only when welding in the vertical position. / **GMAW spray transfer limited to flat position only for groove welds.**

**Prices:** The user-license one-time fee for each SWPS is $204 ($272 for non-members). Not adopted by ASME typesetter.
CHINESE
D1.1/D1.1M:2015, Structural Welding Code—Steel see page 72
D1.5M/D1.5:2010, Bridge Welding Code see page 72
WIT-T:2008, Welding Inspection Technology see page 38

PORTUGUESE
D1.1/D1.1M:2010, Structural Welding Code—Steel see page 72

RUSSIAN
D1.1/D1.1M:2010, Structural Welding Code—Steel see page 72

SPANISH
A2.4:2020, Standard Symbols for Welding, Brazing, and Nondestructive Examination see page 43
A3.0:2020, Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying see page 43
B1.10:2009, Guide for the Nondestructive Examination of Welds see page 32
B1.11:2000, Guide for the Visual Examination of Welds see page 32
B4.0:2007, Standard Methods for Mechanical Testing of Welds see page 32

B5.1:2013-AMD1, Specification for the Qualification of Welding Inspectors see page 34
CM:2000, Certification Manual for Welding Inspectors see page 37
D1.1/D1.1M:2020, Structural Welding Code—Steel see page 72
D1.2/D1.2M:2008, Structural Welding Code—Aluminum see page 72
D1.5M/D1.5:2010, Bridge Welding Code see page 72
D15.1/D15.1M:2019, Railroad Welding Specification for Cars and Locomotives see page 71
D17.1:2017 AMD2, Specification for Fusion Welding for Aerospace Applications see page 65
WI:2000, Welding Inspection Handbook see page 32
WIT-T:2000, Welding Inspection Technology see page 38
Z49.1:2012, Safety in Welding, Cutting, and Allied Processes see page 45
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<table>
<thead>
<tr>
<th>Member price: $15</th>
<th>Non member price: $20 per chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume 1, 10th Edition Welding and Cutting Science and Technology</td>
<td></td>
</tr>
<tr>
<td>Part I – The Science of Welding, Cutting, and Allied Processes</td>
<td></td>
</tr>
<tr>
<td>WHC1.01: Survey of Joining, Cutting, &amp; Allied Processes</td>
<td></td>
</tr>
<tr>
<td>WHC1.02: Physics of Welding and Cutting</td>
<td></td>
</tr>
<tr>
<td>WHC1.03: Heat Flow in Welding</td>
<td></td>
</tr>
<tr>
<td>WHC1.04: Welding Metallurgy</td>
<td></td>
</tr>
<tr>
<td>Part II – Design Considerations</td>
<td></td>
</tr>
<tr>
<td>WHC1.05: Design for Welding</td>
<td></td>
</tr>
<tr>
<td>WHC1.06: Symbols for Joining and Inspection</td>
<td></td>
</tr>
<tr>
<td>WHC1.07: Residual Stress and Distortion</td>
<td></td>
</tr>
<tr>
<td>WHC1.08: Economics of Welding and Cutting</td>
<td></td>
</tr>
<tr>
<td>Part III – Automation of Joining Processes</td>
<td></td>
</tr>
<tr>
<td>WHC1.09: Mechanized, Automated, and Robotic Welding</td>
<td></td>
</tr>
<tr>
<td>WHC1.10: Weldment Tooling and Positioning</td>
<td></td>
</tr>
<tr>
<td>WHC1.11: Monitoring and Control of Welding and Joining Processes</td>
<td></td>
</tr>
<tr>
<td>Part IV – Quality, Testing Standards, and Methods</td>
<td></td>
</tr>
<tr>
<td>WHC1.12: Weld Quality</td>
<td></td>
</tr>
<tr>
<td>WHC1.13: Test Methods for Evaluating Welded Joints</td>
<td></td>
</tr>
<tr>
<td>WHC1.14: Welding Inspection and Nondestructive Examination</td>
<td></td>
</tr>
<tr>
<td>WHC1.15: Personnel Qualification and Certification</td>
<td></td>
</tr>
<tr>
<td>WHC1.16: Codes and Other Standards</td>
<td></td>
</tr>
<tr>
<td>Part V – Safety and Health</td>
<td></td>
</tr>
<tr>
<td>WHC1.17: Safe Practices</td>
<td></td>
</tr>
<tr>
<td>Volume 2, Welding Processes, Part 1</td>
<td></td>
</tr>
<tr>
<td>WHC2.01: Arc Welding Power Sources</td>
<td></td>
</tr>
<tr>
<td>WHC2.02: Shielded Metal Arc Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.03: Gas Tungsten Arc Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.04: Gas Metal Arc Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.05: Flux Cored Arc Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.06: Submerged Arc Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.07: Plasma Arc Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.08: Electrogas Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.09: Arc Stud Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.10: Electroslag Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.11: Oxyfuel Gas Welding</td>
<td></td>
</tr>
<tr>
<td>WHC2.12: Brazing</td>
<td></td>
</tr>
<tr>
<td>WHC2.13: Soldering</td>
<td></td>
</tr>
<tr>
<td>WHC2.14: Oxygen Cutting</td>
<td></td>
</tr>
<tr>
<td>WHC2.15: Arc Cutting and Gouging</td>
<td></td>
</tr>
<tr>
<td>Volume 3, Welding Processes, Part 2</td>
<td></td>
</tr>
<tr>
<td>WHC3.01: Resistance Spot and Seam Welding</td>
<td></td>
</tr>
<tr>
<td>WHC3.02: Projection Welding</td>
<td></td>
</tr>
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<td>WHC5.10: Composites</td>
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### C3.2M/C3.2:2019, Standard Method for Evaluating the Strength of Brazed Joints
Describes the test methods used to obtain reliable data on the strength of metal-to-metal, metal-to-nonmetal, and nonmetal-to-nonmetal joints. 42 pages, 16 figures, 4 tables.

Order Code: C3.2

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### 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

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### 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.

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### C3.6M/C3.6:2016-AMD1, 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

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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

$48 $64

C3.8M/C3.8:2020, 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

$60 $80

C3.9M/C3.9:2020, 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

$48 $64

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

$48 $64

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

$48 $64

This standard describes and illustrates the test methods used to obtain information related to brazed joint quality and structural integrity. Verification methods include visual observation, as well as metallography of such parameters as braze wetting, braze joint erosion, brazing filler metal penetration, differences between excess wetting, lack of wetting and dewetting, and formation of voids, cracks, and features which may be detrimental to end use. Additionally, methods to determine diffusion of braze alloying elements and procedures to qualify such methods are described. Photographs illustrating visual inspection, schematic illustrations, and photomicrographs illustrating various aspects of brazed joint integrity are presented.

Order Code: C3.14

$54 $72
see page 33

see page 33

A5.8M/A5.8:2019, Specification for Filler Metals for Brazing and Braze Welding
see page 78

A5.31M/A5.31:2012, Specification for Fluxes for Brazing and Braze Welding
see page 78

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.
Order Code: BRH $114 $152

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.
Order Code: SHB $120 $160

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.
Order Code: GHSP $75 $100
PURCHASE SPECIFIC BRAZING AND SOLDERING HANDBOOK CHAPTERS

Get valuable information from the Brazing Handbook and Soldering Handbook on specific topics without the need to purchase the whole book. Individual chapters of both books are now available as a PDF download from aws.org/handbook.

Member price: $18  |  Non member price: $24 per chapter

BRAZING HANDBOOK CHAPTERS
1: Basics of Brazing  BHC1
2: Brazement Design  BHC2
3: Brazing Filler Metals  BHC3
4: Fluxes and Atmospheres  BHC4
5: Precleaning and Surface Preparation  BHC5
6: Assembly and Fixturing  BHC6
7: Corrosion of Brazed Joints  BHC7
8: Inspection of Brazed Joints  BHC8
9: Codes and Other Standards  BHC9
10: Safety and Health  BHC10
11: Introduction to the Brazing Processes  BHC11
12: Torch Brazing  BHC12
13: Induction Brazing  BHC13
14: Furnace Brazing  BHC14
15: Dip Brazing  BHC15
16: Resistance Brazing  BHC16
17: Diffusion Brazing  BHC17
18: Other Brazing Processes  BHC18
19: Braze Welding  BHC19
20: Aluminum and Aluminum Alloys  BHC20
21: Graphite and Carbon-Carbon Composites  BHC21
22: Cemented Carbides and Cermets  BHC22
23: Cast Iron  BHC23
24: Ceramics  BHC24
25: Copper and Copper Alloys  BHC25
26: Low-Carbon, Low-Alloy, and Tool Steels  BHC26
27: Magnesium and Magnesium Alloys  BHC27
28: Nickel-Based and Cobalt-Containing Alloys  BHC28
29: Precious Metals  BHC29
30: Reactive Metals: Titanium, Zirconium, and Beryllium  BHC30
31: Refractory Metals: Niobium, Molybdenum, Tantalum, and Tungsten  BHC31
32: Stainless Steels  BHC32
33: Electron Tubes and Vacuum Equipment  BHC33
34: Honeycomb Structures  BHC34
35: Pipe and Tubing  BHC35
36: Diamond  BHC36

SOLDERING HANDBOOK CHAPTERS
1: Fundamentals of Soldering Technology  SHC1
2: Solder Materials  SHC2
3: Substrate Materials  SHC3
4: Fluxes  SHC4
5: Solder Pastes  SHC5
6: Assembly Processes  SHC6
7: Inspection Techniques for Product Acceptance and Process Optimization  SHC7
8: Environmental, Safety, and Health  SHC8
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.
Order Code: D18.1 $60 $80

D18.2:2020, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube
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 $45 $60
13” X 19” Order Code: D18.2XL $54 $72

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.
Order Code: D18.3 $51 $68
C1.1M/C1.1:2019, *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, 58 tables, 39 figures.
Order Code: **C1.1**
Member $90  Non Member $120

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**
Member $51  Non Member $68

C1.5:2019, *Specification for the Qualification of Resistance Welding Technicians* see page 35


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.
Order Code: **J1.1**
Member $54  Non Member $72

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**
Member $54  Non Member $72

This standard builds upon the globally recognized material classification system described in the Resistance Welder Manufacturers’ Association (RWMA) Bulletin 16, Resistance Welding Equipment Standards, last published in 1996. The standard provides updated and expanded information useful to material and electrode manufacturers, distributors, and end users. This document describes common materials to facilitate identification and minimize variation. It is not intended to limit the range of resistance welding products or processes in the marketplace. 46 pages, 19 tables.
Order Code: **J1.3**
Member $54  Non Member $72
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<th>Publication</th>
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<tr>
<td>RWMA Bulletin #14: Maintenance Manual for Resistance Welding Machines</td>
<td>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.</td>
<td>$35</td>
<td>$46</td>
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<td>RWMA Bulletin #16: Resistance Welding Equipment Standards</td>
<td>RWMA standards for welding equipment, including electrical, electrode, and fluid-power standards.</td>
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<td>RWMA Bulletin #34: Manufacturer’s Cross Reference of Standard Resistance Welding Electrode Numbers and Alloys</td>
<td>An extensive cross-reference of standard resistance welding electrodes and alloys recognized by the RWMA.</td>
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<td>$48</td>
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<tr>
<td>RWMA Resistance Welding Manual, Revised Fourth Edition</td>
<td>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”.</td>
<td>$99</td>
<td>$132</td>
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<tr>
<td>Introduction to Resistance Welding Video</td>
<td>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.</td>
<td>$99</td>
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<td>QC20:2020, Specification for AWS Certification of Resistance Welding Technicians</td>
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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  
Member: $54  
Non Member: $72

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.

Order Code: D16.1  
Member: $57  
Non Member: $76

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.

Order Code: D16.2  
Member: $51  
Non Member: $68

Provides recommendations and guidelines for the safe application of robotic arc welding systems. 36 pages, 1 figure, 4 tables.

Order Code: D16.3  
Member: $51  
Non Member: $68

see page 36

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.

Order Code: D16.6  
Member: $51  
Non Member: $68

*see page 35*

Order Code: C2.16

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C2.18-93R, *Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites*

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).

Order Code: C2.18

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Replaces MIL-STD-1687A(SH). Defines requirements for high-velocity oxygen fuel coatings as alternatives to hard chrome plating. Details essential equipment, surface prep, and application of thermal spray coatings and sealers with in-process quality control checkpoints. Includes procedures for qualification, procedure approval, and documentation. 68 pages, 8 figures, 7 tables.

Order Code: C2.19

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C2.20/C2.20M:2016, *Specification for Thermal Spraying Zinc Anodes on Steel Reinforced Concrete*

This AWS standard is a specification for thermal spraying zinc anodes on steel reinforced concrete. This standard is formatted as an industrial process instruction. The scope includes: job description, safety, pass/fail job reference standards, feedstock materials, equipment, a step-by-step process instruction for surface preparation, thermal spraying, and quality control. There are five annexes, including job control record and portable adhesion testing. 48 pages, 3 figures, 5 tables.

Order Code: C2.20

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This standard specifies the essential elements of a procedure for verifying the performance of thermal spray equipment to ensure it is capable of operating according to the manufacturer’s specifications or those established by the user. 38 pages

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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.

Order Code: C2.23

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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).

Order Code: C2.25

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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.

Order Code: TST

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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.

Order Code: TSS

$102 $136

A3.1:2020, Master Chart of Welding and Joining Processes
24” by 30” chart extracted from A3.0.

Order Code: A3.1

$33 $44

Consists of a plastic gauge with samples of oxygen-cut surfaces, a list of descriptive terms, and an accompanying chart. 18 pages (Reaffirmed 2009).

Order Code: C4.1 SET

$51 $68

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.

Order Code: C4.2

$54 $72

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.

Order Code: C4.3

$54 $72

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

$57 $76

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

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<td>C4.6M:2006</td>
<td>Thermal Cutting – Classification of Thermal Cuts – Geometric Product Specification and Quality Tolerances</td>
<td>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).</td>
<td>C4.6</td>
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<td>C5.3:2000</td>
<td>Recommended Practices for Air Carbon Arc Gouging and Cutting</td>
<td>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).</td>
<td>C5.3</td>
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<tr>
<td>C6.1-89</td>
<td>Recommended Practices for Friction Welding</td>
<td>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).</td>
<td>C6.1</td>
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<td>C6.2/C6.2M:2006</td>
<td>Specification for Friction Welding of Metals</td>
<td>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.</td>
<td>C6.2</td>
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<td>C7.1M/C7.1:2013</td>
<td>Recommended Practices for Electron Beam Welding and Allied Processes</td>
<td>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.</td>
<td>C7.1</td>
<td>$84</td>
<td>$112</td>
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<td>C7.2M:2010</td>
<td>Recommended Practices for Laser Beam Welding, Cutting, and Allied Processes</td>
<td>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.</td>
<td>C7.2</td>
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<td>C7.3:2016</td>
<td>Process Specification for Electron Beam Welding</td>
<td>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.</td>
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AEROSPACE WELDING PROCESS PUBLICATIONS

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
$132 $176
Spanish Edition (2017) $57 $57

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
$60 $80

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 $57 $76

AUTOMOTIVE WELDING PROCESS PUBLICATIONS

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 $51 $68

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 $54 $72

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 $48 $64

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 $81 $108

This specification covers the arc welding of automotive components that are manufactured from aluminum alloys. 42 pages.
Order Code: D8.14 $54 $72
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  $90 $120

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, tractors, 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.
Order Code: D14.3  $81 $108

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  $90 $120

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  $90 $120

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, crankshafts, 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  $66 $88
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 $60 $80

see page 64

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.
Order Code: D14.9 $60 $80

HEAVY MACHINERY BUNDLES

BUNDLE E
Order Code: BUNDLE E YOU SAVE $56/$42 $249 $332

BUNDLE F
Order Code: BUNDLE F YOU SAVE $56/$42 $237 $316
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**

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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**

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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**

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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**

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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**

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**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

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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

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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

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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

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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

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**PIPE & TUBING**

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**
Member: $51  
Non Member: $68

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**
Member: $66  
Non Member: $88

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**
Member: $54  
Non Member: $72


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

**F4.1:2017, Safe Practices for the Preparation of Containers and Piping for Welding, Cutting, and Allied Processes** see page 46

**Pipe Welding Standard Welding Procedure Specifications (SWPSs)** see page 49
B2.4:2012, Specification for Welding Procedure and Performance Qualification for Thermoplastics see page 34

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 $69 $92

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 $48 $64

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 36

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 $78 $100

This specification establishes minimum welding standards for the manufacture and maintenance of railcars, locomotives, and their components, intended for North American railroad service. Clauses 4 through 17 cover the general requirements for welding in the railroad industry. Clauses 18 through 23 cover specific requirements for the welding of base metals thinner than 1/8 in [3 mm]. 260 pages.
Order Code: D15.1 $129 $172

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, thermit welding, electric flash welding guidelines, procedure qualification, and welder qualification. 64 pages, 23 figures, 7 tables.
Order Code: D15.2 $60 $80
### D1.1/D1.1M:2020, Structural Welding Code—Steel
For everyone involved in any phase of welding steel structures—Engineers, detailers, fabricators, erectors, inspectors, etc. — the latest D1.1 spells out the requirements for design, procedures, qualification, fabrication, inspection, stud welding, and repair of steel structures made of tubes, plate, and structural shapes that are subject to either static or cyclic loading. U.S. Customary and SI units of measurement. Over 650 pages, 19 annexes, 101 tables, and 184 figures, commentary. To see the main differences between the 2015 and 2020 editions, visit [aws.org/member_d1](http://aws.org/member_d1)

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### D1.1-SWJ-WC, Welded Joint Details for Structural Applications Wall Chart
A 36”-by-27” wall chart with selected joint details conforming to D1.1/D1.1M:2008 and 2010, applicable to low-carbon steel plate and shapes for structural applications.

**Order Code:** D1.1-SWJ-WC  
**Price:** $39 / $52

### D1.2/D1.2M:2014, Structural Welding Code—Aluminum
Covers welding requirements for any type of structure made from aluminum structural alloys, except aluminum pressure vessels and fluid-carrying pipelines. Includes sections on design of welded connections, procedure and performance qualification, fabrication, inspection, stud welding, and strengthening and repair of existing structures. A commentary offers guidance on interpreting and applying the code. 230 pages.

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### D1.3/D1.3M:2018, Structural Welding Code—Sheet Steel
This code covers the requirements associated with welding sheet steel having a minimum specified yield point no greater than 80 ksi [550 MPa]. The code requirements cover any welded joint made from the commonly used structural quality low-carbon hot rolled and cold rolled sheet and strip steel with or without zinc coating (galvanized). 106 pages, 5 Annexes, 11 Tables, and 48 Figures, commentary.

**Order Code:** D1.3  
**Price:** $111 / $148

### D1.4/D1.4M:2018, Structural Welding Code—Steel Reinforcing Bars
Covers requirements for welding steel reinforcing bars in most reinforced concrete applications. Includes a new clause on the design of welded joints, structural details, workmanship requirements, technique, procedure and performance qualification, and inspection. New content: GTAW now permitted as a prequalified welding process; lap joints; bar diameter range; effects of eccentricity; foreign materials and coatings; and radiographic methodology conforming to ASTM E94. New Table 4.1 covers design strength. 98 pages, 20 figures, 12 tables.

**Order Code:** D1.4  
**Price:** $105 / $140

### AASHTO/AWS D1.5M/D1.5:2020, Bridge Welding Code
Includes amendment. Covers welding requirements of the American Welding Society (AWS) and the American Association of State Highway and Transportation Officials (AASHTO) for welded highway bridges made from carbon, low-alloy high strength, and high performance steels. Covers design of welded connections, workmanship, technique, procedure and performance qualification, inspection, fracture control plan, and stud welding. Features content on advanced ultrasonic examination requirements. 490 pages, 18 annexes, 97 figures, 49 tables, 9 forms, commentary.

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WELDING PROCESS PUBLICATIONS

D1.6/D1.6M:2017, Structural Welding Code—Stainless Steel
Covers requirements for welding stainless steel structural assemblies/components (excluding pressure vessels or pressure piping) using gas metal arc welding, shielded metal arc welding, flux cored arc welding, submerged arc welding, and stud welding. Allows qualification directly under AWS B2.1 without approval from the Engineer, all while retaining D1.6 code qualification requirements. Clauses include design, procedure and performance qualification, fabrication, inspection, and stud welding. 340 pages, 10 annexes, 98 figures, 33 tables, 10 forms, commentary.

Order Code: D1.6 $219 $292

D1.7/D1.7M:2010, Guide for Strengthening and Repairing Existing Structures
Provides engineers and contractors with general direction and guidance on weld repairs, weld strengthening, and other procedures to correct problematic issues with existing structures made of steel (minimum yield strength of 100 ksi and minimum thickness of 1/8 inch), cast iron, and wrought iron. 52 pages, 4 tables.

Order Code: D1.7 $93 $124

D1.8/D1.8M:2016, Structural Welding Code—Seismic Supplement
This document supplements the requirements to the D1.1/D1.1M Structural Welding Code as it relates to seismic provisions. It is intended to cover common applications to welded joints in Seismic Force Resisting Systems designed in accordance with the American Institute of Steel Construction, Inc. Seismic Provisions. Covers additional controls on detailing, materials, workmanship, testing, and inspection necessary to achieve adequate performance of welded steel structures under conditions of severe earthquake-induced inelastic straining. 138 pages, 9 annexes, commentary, 23 figures, 8 tables.

Order Code: D1.8 $123 $164

D1.9/D1.9M:2015, Structural Welding Code—Titanium
Covers requirements for design, welding, and inspection of any type of titanium structure, except pressure vessels, pressure piping, and aerospace structures. Includes qualification requirements for weld procedures and personnel. 156 pages, commentary, 6 annexes, 53 figures, 19 tables.

Order Code: D1.9 $102 $136

ASTM Standards for Welding
A compilation of all 60 ASTM standards referenced by AWS D1.1 Structural Welding Code—Steel. An excellent companion to D1.1, it can be ordered at a savings bundled with D1.1/D1.1M:2020. 565 pages, 60 standards.

Order Code: ASTMSW $372 $496
## STRUCTURAL BUNDLES

### Bundle A
- D1.1/D1.1M:2020, Structural Welding Code–Steel
- A2.4:2020, Standard Symbols for Welding, Brazing, and Nondestructive Examination
- A3.0M/A3.0:2020, Standard Welding Terms and Definitions

Order Code: **BUNDLE A**  YOU SAVE $114 / $152

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### Bundle B
- D1.1/D1.1M:2020, 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/D1.5:2020, Bridge Welding Code
- D1.6/D1.6M:2017, Structural Welding Code–Stainless Steel

Order Code: **BUNDLE B**  YOU SAVE $211 / $282

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### Bundle C
- A2.4:2020, Standard Symbols for Welding, Brazing, and Nondestructive Examination
- D1.5M/D1.5:2020, Bridge Welding Code

Order Code: **BUNDLE C**  YOU SAVE $69 / $92

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### Bundle D (Seismic Bundle)
- D1.1/D1.1M:2020, Structural Welding Code–Steel
- D1.8/D1.8M:2016, Structural Welding Code–Seismic Supplement

Order Code: **BUNDLE D**  YOU SAVE $120 / $90

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### ASTM Standards bundled with D1.1/D1.1M:2020

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For Heavy Machinery Bundles see page 67
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

Member $84  
Non Member $112

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

Member $60  
Non Member $80

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

Member $78  
Non Member $104


Order Code G2.4

Member $57  
Non Member $76

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.

Order Code: G2.5

Member $54  
Non Member $72

Welding Stainless Steel—Questions and Answers

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

Member $126  
Non Member $168

Welding Zinc-Coated Steels see page 47
### WELDING PROCESS PUBLICATIONS

#### CONSUMABLES & RELATED PRODUCTS

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Title</th>
<th>Pages</th>
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<tbody>
<tr>
<td>A4.3:1993-ADD1, Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding</td>
<td>26</td>
<td></td>
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<td>A4.3</td>
<td>$54</td>
<td>$72</td>
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<tr>
<td>A4.4M:2001 (R2016), Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings</td>
<td>32</td>
<td>4</td>
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<tr>
<td>A5.01M/A5.01:2019 (ISO 14344:2010 MOD), Welding Consumables – Procurement of Filler Metals and Fluxes</td>
<td>38</td>
<td>9</td>
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<td></td>
<td>A5.01</td>
<td>$54</td>
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<tr>
<td>A5.02/A5.02M:2007, Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes</td>
<td>28</td>
<td>4</td>
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<td></td>
<td>A5.02</td>
<td>$54</td>
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<tr>
<td>A5.32M/A5.32:2011 (ISO 14175:2008 MOD), Welding Consumables – Gases and Gas Mixtures for Fusion Welding and Allied Processes</td>
<td>42</td>
<td>5</td>
<td></td>
<td></td>
<td>A5.32</td>
<td>$54</td>
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<tr>
<td>C2.25/C2.25M:2012 (R2018), Specification for Thermal Spray Feedstock—Wire and Rods</td>
<td>see page 62</td>
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<td></td>
<td></td>
<td></td>
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</table>

See page 62 for details.
# AWS Filler Metal Specifications by Material and Welding Process

<table>
<thead>
<tr>
<th>Material</th>
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<td>A5.2</td>
<td>A5.1 • A5.35</td>
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## Save when you buy multiple A5 Filler Metal Specs

These crucial specifications give the purchaser and distributor of filler metals a dependable, efficient recognition system. The classifications defined in these standards allow you to identify filler metals uniformly, without consideration of manufacturers’ trade names or brand names. AWS A5 Filler Metal Specifications are ANSI Approved and Dept. of Defense Adopted. For multiple purchases, contact 888.WELDING (935-3464) Option 1

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## AWS A5 Filler Metal and Consumables Specifications

- A5.1/A5.1M:2012 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding (60 pages) A5.1
- A5.2/A5.2M:2018 Specification for Carbon and Low Alloy Steel Rods for Oxyfuel Gas Welding (26 pages) A5.2
- A5.4/A5.4M:2012 Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding (52 pages) A5.4
AWS A5 FILLER METAL AND CONSUMABLES SPECIFICATIONS

A5.5/A5.5M:2014 Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding (68 pages) A5.5
A5.6/A5.6M:2008 (R2017) Specification for Copper and Copper-Alloy Electrodes for Shielded Metal Arc Welding (36 pages) A5.6
A5.7/A5.7M:2007 (R2017) Specification for Copper and Copper Alloy Bare Welding Rods and Electrodes (30 pages) A5.7
A5.8M/A5.8:2019 Specification for Filler Metals for Brazing and Braze Welding (62 pages) A5.8
A5.9/A5.9M:2017 Welding Consumables—Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels—Classification (52 pages) A5.9
A5.14/A5.14M:2018 Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods (40 pages) A5.14
A5.15-90 (R2016) Specification for Welding Electrodes and Rods for Cast Iron (32 pages) A5.15
A5.18/A5.18M:2017 Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding (42 pages) A5.18
A5.21/A5.21M:2011 Specification for Bare Electrodes and Rods for Surfacing (40 pages) A5.21
A5.22/A5.22M:2012 Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods (55 pages) A5.22
A5.28/A5.28M:2020 Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding (46 pages) A5.28
A5.29/A5.29M:2010 Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding (60 pages) A5.29
A5.30/A5.30M:2007 Specification for Consumable Inserts (36 pages) A5.30
A5.31M/A5.31:2012 Specification for Fluxes for Brazing and Braze Welding (36 pages) A5.31
A5.34/A5.34M:2018 Specification for Nickel-Alloy Flux Cored and Metal Cored Welding Electrodes A5.34
A5.35/A5.35M:2015-AMD1 Specification for Covered Electrodes for Underwater Wet Shielded Metal Arc Welding (32 pages) A5.35
A5.39/A5.39M Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys A5.39
This code covers the arc and braze welding requirements for nonstructural sheet metal fabrications using the commonly welded metals available in sheet form. It provides standardized requirements for the qualification, production, and acceptance of welding or braze welding of nonstructural sheet metal components. 75 pages.
Order Code: D9.1
Member $63  Non Member $84

D1.3/D1.3M:2018, Structural Welding Code—Sheet Steel see page 72


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## INDEXES

### PUBLICATIONS SUBJECT INDEX

### AEROSPACE
- D17.1/D17.1M, Specification for Fusion Welding for Aerospace Applications .............................................65
- D17.2/D17.2M, Specification for Resistance Welding for Aerospace Applications .............................................65

### ALUMINUM
- A5.3/A5.3M, Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding ..................77
- A5.10/A5.10M (ISO 18273 MOD), Welding Consumables – Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys – Classification ..................................................78
- C3.7M/C3.7, Specification for Aluminum Brazing .........................................................................................55
- D1.2/D1.2M, Structural Welding Code – Aluminum .......................................................................................72
- D3.7, Guide for Aluminum Hull Welding ...........................................................................................................68
- D8.14M, Specification for Automotive Weld Quality – Arc Welding of Aluminum ...........................................65
- D10.7M/D10.7, Guide for the Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe .....................69

### AUTOMOTIVE
- D8.1M, Specification for Automotive Weld Quality – Resistance Spot Welding of Steel .....................................65
- D8.2M, Specification for Automotive Weld Quality – Resistance Spot Welding of Steel .....................................65
- D8.8M, Specification for Automotive Weld Quality – Arc Welding of Steel ....................................................65
- D8.14M, Specification for Automotive Weld Quality – Arc Welding of Aluminum .............................................65

### BRAZING AND BRAZE WELDING
- A5.8M/A5.8, Specification for Filler Metals for Brazing and Brazing and Brazing ...........................................78
- A5.31M/A5.31, Specification for Fluxes for Brazing and Brazing and Brazing ...........................................78
- B2.2/B2.2M, Specification for Brazing Procedure and Performance Qualification ............................................33
- BHC1, Basics of Brazing ..............................................................................................................................57
- BHC2, Brazement Design ..........................................................................................................................57
- BHC3, Brazing Filler Metal .........................................................................................................................57
- BHC4, Fluxes and Atmospheres ................................................................................................................57
- BHC5, Pre cleaning and Surface Preparation ...............................................................................................57
- BHC6, Assembly and Fixturing ....................................................................................................................57
- BHC7, Corrosion of Brazed Joints ................................................................................................................57
- BHC8, Inspection Brazed Joints ...................................................................................................................57
- BHC9, Codes and Other Standards ............................................................................................................57
- BHC10, Safety and Health .........................................................................................................................57
- BHC11, Introduction to the Brazing Processes ............................................................................................57
- BHC12, Torch Brazing ...................................................................................................................................57
- BHC13, Induction Brazing ............................................................................................................................57
- BHC14, Furnace Brazing ..............................................................................................................................57
- BHC15, Dip Brazing ......................................................................................................................................57
- BHC16, Resistance Brazing ........................................................................................................................57
- BHC17, Diffusion Brazing ............................................................................................................................57
- BHC18, Other Brazing Processes ................................................................................................................57
- BHC19, Braze Welding .................................................................................................................................57
- BHC20, Aluminum and Aluminum Alloys ....................................................................................................57
- BHC21, Graphite and Carbon-Carbon Composites ......................................................................................57
- BHC22, Cemented Carbides and Cermets .................................................................................................57
- BHC23, Cast Iron ..........................................................................................................................................57
- BHC24, Ceramics ..........................................................................................................................................57
- BHC25, Copper and Copper Alloys ..............................................................................................................57
- BHC26, Low-Carbon, Low-Alloy, and Tool Steels .....................................................................................57
- BHC27, Magnesium and Magnesium Alloys ..............................................................................................57
- BHC28, Nickel-Based and Cobalt-Containing Alloys ...............................................................................57
- BHC29, Precious Metals ..............................................................................................................................57
- BHC30, Reactive Metals: Titanium, Zirconium, and Beryllium ................................................................57
- BHC31, Refractory Metals: Niobium, Molybdenum, Tantalum, and Tungsten ...........................................57
- BHC32, Stainless Steels .............................................................................................................................57
- BHC33, Electron Tubes and Vacuum Equipment .......................................................................................57
- BHC34, Honeycomb Structures ................................................................................................................57
- BHC35, Pipe and Tubing .............................................................................................................................57
- BHC36, Diamond ..........................................................................................................................................57
- BRH, Brazing Handbook ............................................................................................................................56
- Soldering Handbook .....................................................................................................................................56
INDEXES

PUBLICATIONS SUBJECT INDEX

Guideline for Hand Soldering Practices .......................................................... 56
C3.2M/C3.2, Standard Method for Evaluating the Strength of Brazed Joints .......................................................... 54
C3.3, Recommended Practices for the Design, Manufacture, and Examination of Critical Brazed Components .......................................................... 54
C3.4M/C3.4, Specification for Torch Brazing .................................................. 54
C3.5M/C3.5-AMDI, Specification for Induction Brazing .................................. 54
C3.6M/C3.6, Specification for Furnace Brazing ............................................. 54
C3.7M/C3.7, Specification for Aluminum Brazing .......................................... 55
C3.8M/C3.8, Specification for the Pulse-Echo Ultrasonic Examination of Brazed Joints .......................................................... 55
C3.9M/C3.9, Specification for Resistance Brazing ......................................... 55

BRIDGES
AASHTO/AWS D1.5-AMD, Bridge Welding Code .......................................... 72

CARBON STEEL
A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding .......................................................... 77
A5.2/A5.2M, Specification for Carbon and Low Alloy Steel Rods for Oxyfuel Gas Welding .......................................................... 77
A5.17/A5.17M, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding .......................................................... 78
A5.18/A5.18M, Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding .......................................................... 78
A5.20/A5.20M, Specification for Carbon Steel Electrodes for Flux Cored Arc Welding .......................................................... 78
A5.25/A5.25M, Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding .......................................................... 78
A5.26/A5.26M, Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding .......................................................... 78

CAST IRON
A5.15, Specification for Welding Electrodes and Rods for Cast Iron .................. 75
D11.2, Guide for Welding Iron Castings .......................................................... 75

CERTIFICATION
CM, Certification Manual for Welding Inspectors .......................................... 37
CMWS, Certified Welding Supervisor Manual ............................................. 37
QC1, Standard for AWS Certification of Welding Inspectors .................................. 31
QC4, Standard for Accreditation of Test Facilities for AWS Certified Welder Program .......................................................... 30
QC5, Standard for AWS Certification of Welding Educators .................................. 30
QC7, Standard for AWS Certified Welders .................................................. 30
QC7X, QC7 Supplements .......................................................... 30
QC10, Specification for Qualification and Registration of Level I — Entry Welders .......................................................... 30
QC11, Specification for Qualification and Certification for Level II — Advanced Welders .......................................................... 30
QC13, Specification for the Certification of Welding Supervisors .................................. 30
QC14, Specification for the Certification of Welding Sales Representatives .......................................................... 30
QC15-AMDI, Specification for the Certification of Radiographic Interpreters .......................................................... 30
QC17, Specification for AWS Accreditation of Certified Welding Fabricators .......................................................... 31
QC19, Standard for the AWS Certification of Robotic Arc Welding Personnel .......................................................... 31
QC20, Standard for the AWS Certification of Resistance Welding Technicians .......................................................... 31

CHARTS
A2.1 WC, WCXL, and DC Welding Symbol Charts .......................................... 43
A2.1 WC & DC, Welding Symbol Charts .......................................................... 43
A3.1, Master Chart of Welding and Joining Processes ........................................ 43, 63
D1.1-SWJ-WC, Welded Joint Details Wall Chart ............................................. 72
D18.2, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube .......................................................... 58
F2.2, Lens Shade Selector .......................................................... 45

COMPUTERIZATION
A9.5, Guide for Verification and Validation in Computation Weld Mechanics .......................................................... 61

CORROSION RESISTANCE
C2.20/C2.20M, Specification for Thermal Spraying Zinc Anodes on Steel Reinforced Concrete .......................................................... 62
C2.23M/C2.23, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel .......................................................... 62

CUTTING (see also Oxyfuel Welding and Cutting)
A5.12M/A5.12 (ISO 6848 MOD), Specification for Tungsten and Tungsten-Alloy Electrodes for Arc Welding and Cutting .......................................................... 78
C4.6M (ISO 9013 IDT), Thermal Cutting—Classification of Thermal Cuts—Geometric Product Specification and Quality Tolerances .......................................................... 64

(see also Oxyfuel Welding and Cutting)
<table>
<thead>
<tr>
<th>INDEXES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLICATIONS SUBJECT INDEX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrodes (see Filler Metals)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrogas and Electroslag Welding</strong></td>
</tr>
<tr>
<td>A5.25/A5.25M, Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding</td>
</tr>
<tr>
<td>A5.26/A5.26M, Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electron Beam Welding</th>
</tr>
</thead>
<tbody>
<tr>
<td>C7.1M/C7.1, Recommended Practices for Electron Beam Welding and Allied Processes</td>
</tr>
<tr>
<td>C7.3, Process Specification for Electron Beam Welding</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Filler Metals and Fluxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4.2M (ISO 8429 MOD), Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal</td>
</tr>
<tr>
<td>A4.3, Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding</td>
</tr>
<tr>
<td>A4.4M, Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings</td>
</tr>
<tr>
<td>A4.5M/A4.5 (ISO 15792-3 MOD), Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld</td>
</tr>
<tr>
<td>A5.01M/A5.01 (ISO 14344 MOD), Welding Consumables–Procurement of Filler Metals and Fluxes</td>
</tr>
<tr>
<td>A5.02/A5.02M, Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes</td>
</tr>
<tr>
<td>A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.2/A5.2M, Specification for Carbon and Low-Alloy Steel Rods for Oxyfuel Gas Welding</td>
</tr>
<tr>
<td>A5.3/A5.3M, Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.4/A5.4M, Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.5/A5.5M, Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.6/A5.6M, Specification for Copper and Copper-Alloy Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.7/A5.7M, Specification for Copper and Copper-Alloy Bare Welding Rods and Electrodes</td>
</tr>
<tr>
<td>A5.8M/A5.8, Specification for Filler Metals for Brazing and Braze Welding</td>
</tr>
<tr>
<td>A5.9/A5.9M (ISO 14343 MOD), Welding Consumables–Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels–Classification</td>
</tr>
<tr>
<td>A5.10/A5.10M (ISO 18273 MOD), Welding Consumables–Wire Electrodes, Wires and Rods for a Welding of Aluminum and Aluminum-Alloys–Classification</td>
</tr>
<tr>
<td>A5.11/A5.11M, Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.12M/A5.12 (ISO 6848 MOD), Specification for Tungsten and Oxide Dispersed Tungsten Electrodes for Arc Welding and Cutting</td>
</tr>
<tr>
<td>A5.13/A5.13M, Specification for Surfacing Electrodes for Shielded Metal Arc Welding</td>
</tr>
<tr>
<td>A5.14/A5.14M, Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods</td>
</tr>
<tr>
<td>A5.15, Specification for Welding Electrodes and Rods for Cast Iron</td>
</tr>
<tr>
<td>A5.16/A5.16M (ISO 24034 MOD), Specification for Titanium and Titanium Alloy Welding Electrodes and Rods</td>
</tr>
</tbody>
</table>
A5.17/A5.17M, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding................................. 78
A5.18/A5.18M, Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding................................. 78
A5.19, Specification for Magnesium Alloy Welding Electrodes and Rods................................................................. 78
A5.20/A5.20M, Specification for Carbon Steel Electrodes for Flux Cored Arc Welding................................................. 78
A5.21/A5.21M, Specification for Bare Electrodes and Rods for Surfacing ................................................................. 78
A5.22/A5.22M, Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods............... 78
A5.23/A5.23M, Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding......................... 78
A5.24/A5.24M, Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods........................................ 78
A5.25/A5.25M, Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding.............. 78
A5.26/A5.26M, Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding............................... 78
A5.28/A5.28M, Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Metal Arc Welding............... 78
A5.29/A5.29M, Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding............................................ 78
A5.30/A5.30M, Specification for Consumable Inserts .................................................................................................. 78
A5.31M/A5.31, Specification for Fluxes for Brazing and Braze Welding ...................................................................... 78
A5.34/A5.34M, Specification for Nickel-Alloy Flux Cored and Metal Cored Welding Electrodes................................. 78
A5.35/A5.35M, Specification for Covered Electrodes for Underwater Wet Shielded Metal Arc Welding...................... 78
A5.39/A5.39M, Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys .................................................. 78

FLUX CORED ARC WELDING (see Gas Metal Arc)

FLUXES (see Filler Metals and Fluxes)

FOOD PROCESSING SYSTEMS
D18.1, Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications.. 58
D18.2, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube.................................................. 58
D18.3/D18.3M, Specification for Welding of Tanks, Vessels, and Other Equipment in Sanitary (Hygienic) Applications........ 58

FRICITION WELDING
C6.1, Recommended Practices for Friction Welding................................................................................................. 64
C6.2/C6.2M, Specification for Friction Welding of Metals ...................................................................................... 64
D17.3/D17.3M, Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Applications ....................... 65

GAS TUNGSTEN ARC WELDING
A5.22, Specification for Stainless Steel Electrodes for Flux Cored Arc Welding and Stainless Steel Flux Cored Rods for Gas Tungsten Arc Welding........................................... 78
D10.6/D10.6M, Recommended Practices for Gas Tungsten Arc Welding of Titanium Piping and Tubing.................. 69

GOUGING (see Cutting)

HEALTH (see Safety & Health)

INSPECTION
B1.10M/B1.10, Guide for the Nondestructive Examination of Welds........................................................................... 32
B1.11M/B1.11, Guide for the Visual Examination of Welds ...................................................................................... 32
B4.0, Standard Methods for Mechanical Testing of Welds, U.S. Customary Only ......................................................... 32
B4.0M, Standard Methods for Mechanical Testing of Welds, Metric Only .............................................................. 32
C3.3, Recommended Practices for the Design, Manufacture, and Examination of Critical Brazed Components ........... 54
C3.8M/C3.8, Specification for the Pulse-Echo Ultrasonic Examination of Brazed Joints .............................................. 55
D18.2, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube.......................................... 58
G1.2M/G1.2, Specification for Standardized Ultrasonic Welding Test Specimen for Thermoplastics ......................... 71
G1.6, Specification for the Qualification of Plastics Welding Inspectors for Hot Gas, Hot Gas Extrusion, and Heated Tool Butt Thermoplastic Welds......................................................... 96
QC1, Standard for AWS Certification of Welding Inspectors .................................................................................... 30
QC15-AMD1, Specification for the Certification of Radiographic Interpreters .......................................................... 30
W1, Welding Inspection Handbook ...................................................................................................................... 32
WIT-T, Welding Inspection Technology .............................................................................................................. 38
WIT-W, Welding Inspection Technology Workbook ............................................................................................. 38
10KIT, 10-Piece Toolkit ......................................................................................................................................... 33, 38
INDEXES
PUBLICATIONS SUBJECT INDEX

LASER BEAM WELDING
C7.2M, Recommended Practices for Laser Beam Welding, Cutting, and Allied Processes ......................................................... 64
C7.4/C7.4M, Process Specification and Operator Qualification for Laser Beam Welding ............................................................... 35
C7.6/C7.6M, Process Specification and Operator Qualification for Laser Hybrid Welding ............................................................... 35

MACHINERY AND EQUIPMENT
D14.1/D14.1M-AMD1, Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment ............... 66
D14.6/D14.6M, Specification for Welding of Rotating Elements of Equipment .................................................................................. 66
D14.8M, Standard Methods for the Avoidance of Cold Cracks .......... 64

MANAGEMENT AND ECONOMICS
TWM, Total Welding Management .................................................................................................................................................. 44

MARINE
D3.5, Guide for Steel Hull Welding ....................................................................................................................................................... 68
D3.6M, Underwater Welding Code ..................................................................................................................................................... 68
D3.7, Guide for Aluminum Hull Welding ........................................................................................................................................ 68
D3.9, Specification for Classification of Weld-Through Paint Primers .............................................................................................. 68

METALLURGY
WM1.4, Welding Metallurgy, Carbon and Alloy Steels, Volume 1, Fundamentals .............................................................................. 43

NICKEL
G2.1M/G2.1, Guide for the Joining of Wrought Nickel-Based Alloys ........................................................................................................ 75

OXYFUEL WELDING AND CUTTING
C4.1 SET, Criteria for Describing Oxygen-Cut Surfaces, and Oxygen Cutting Surface Roughness Gauge ....................................................... 63
C4.2/C4.2M, Recommended Practices for Safe Oxyfuel Gas Cutting Torch Operation .............................................................................. 63
C4.3/C4.3M, Recommended Practices for Safe Oxyfuel Gas Heating Torch Operation ........................................................................... 63
C4.4/C4.4M, Recommended Practices for Heat Shaping and Straightening with Oxyfuel Gas Heating Torches ......................... 63
C4.5M, Uniform Designation System for Oxyfuel Nozzles .................................................................................................................. 63
C4.6M, Thermal Cutting – Classification of Thermal Cuts – Geometric Product Specification and Quality Tolerances ................. 64

PIPING AND TUBING
D10.4, Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing ......................... 69
D10.6/D10.6M, Recommended Practices for Gas Tungsten Arc Welding of Titanium Piping and Tubing ........................................ 69
D10.7M/D10.7, Guide for Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe ......................................................... 69
D10.8, Recommended Practices for Welding of Chromium-Molybdenum Steel Piping and Tubing .................................................................................................................. 69
D10.10/ D10.10M, Recommended Practices for Local Heating of Welds in Piping and Tubing ................................................................. 69
D10.11M/ D10.11, Guide for Root Pass Welding of Pipe Without Backing ............................................................................................... 69
D10.12M/ D10.12, Guide for Welding Mild Steel Pipe ......................................................................................................................... 70
D10.18M/ D10.18, Guide for Welding Ferritic/Austenitic Duplex Stainless Steel Piping and Tubing .......................................................... 70
D18.2, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube .............................................................................. 58
F4.1, Safe Practices for the Preparation of Containers and Piping for Welding, Cutting, and Allied Processes ................................. 46

PLASTICS
B2.4, Specification for Welding Procedure and Performance Qualification for Thermoplastics .................................................................. 34
G1.1M/G1.1, Guide to Ultrasonic Assembly of Thermoplastics .............................................................................................................. 71
INDEXES
PUBLICATIONS SUBJECT INDEX

G1.2M/G1.2, Specification for Standardized Ultrasonic Welding Test Specimen for Thermoplastics ....................................................... 71
G1.6, Specification for the Qualification of Plastics Welding Inspectors for Hot Gas, Hot Gas Extrusion, and Heated Tool Butt Thermoplastic Welds ....................................................... 36
G1.10M, Guide for the Evaluation of Thermoplastic Welds ............... 71

QUALIFICATION: PROCEDURES AND PERSONNEL
B2.1/BMG, Base Metal Grouping for Welding B2.1M-Procedure and Performance Qualification .................................................. 33
B2.2/B2.2M, Specification for Brazing Procedure and Performance Qualification ............................................. 33
B2.3/B2.3M, Specification for Soldering Procedure and Performance Qualification .................................................. 33
B2.4, Specification for Welding Procedure and Performance Qualification for Thermoplastics ............................................. 34
B5.1-AMD1, Specification for the Qualification of Welding Inspectors ........................................................................... 34
B5.2, Specification for the Qualification of Welding Inspector Specialists and Welding Inspector Assistants ...................... 34
B5.4, Specification for the Qualification of Welder Test Facilities .... 34
B5.5, Specification for the Qualification of Welding Educators ...... 34
B5.9, Specification for the Qualification of Welding Supervisors .... 34
B5.14, Specification for the Qualification of Welding Sales Representatives ............................................. 34
B5.15, Specification for the Qualification of Radiographic Interpreters ........................................................................... 35
B5.16, Specification for the Qualification of Welding Engineers ..... 35
B5.17, Specification for the Qualification of Welding Fabricators ..... 35
C1.5, Specification for the Qualification of Resistance Welding Technicians ........................................................................... 35
C2.16/C2.16M, Guide for Thermal Spray Operator Qualification Programs ........................................................................... 35
C7.4/C7.4M, Process Specification and Operator Qualification for Laser Beam Welding ..................................................... 35
C7.6/C7.6M, Process Specification and Operator Qualification for Laser Hybrid Welding ..................................................... 35
D16.4M/D16.4, Specification for the Qualification of Robotic Arc Welding Personnel ..................................................... 36
EG2.0, Guide for the Training of Welding Personnel; SENSE Level I – Entry Welders ..................................................... 36
EG2.0:2017, Supplement Guide to the Training of Welding Personnel; Level I – Entry Welder ..................................................... 36
EG3.0, Guide for Training and Qualification of Welding Personnel; Level II – Advanced Welder ..................................................... 36
EG3.0, Supplement SENSE Level II – Advanced Welder Training ........................................................................... 36
G1.6, Specification for the Qualification of Plastics Welding Inspectors for Hot Gas, Hot Gas Extrusion, and Heated Tool Butt Thermoplastic Welds ..................................................... 36
Best Practices for Performing a Welder Qualification Test .............. 37

RADIOGRAPHY (see also Inspection)
B5.15, Specification for the Qualification of Radiographic Interpreters ........................................................................... 35
QC15-AMD1, Specification for the Certification of Radiographic Interpreters ........................................................................... 30

RAILROADS
D15.1/D15.1M, Railroad Welding Specification for Cars and Locomotives .......................................................... 71
D15.2/D15.2M, Recommended Practices for the Welding of Rails and Related Rail Components for Use by Rail Vehicles ........ 71

REFERENCE
A1.1, Metric Practice Guide for the Welding Industry ...................... 43
A2.1 WC&DC, Welding Symbols Charts ............................................. 43
A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination .......................................................... 43
A3.0M/A3.0, Standard Welding Terms and Definitions .................. 43
A3.1, Master Chart of Welding and Joining Processes .................... 43, 63
JWE, Jefferson’s Welding Encyclopedia ........................................ 43
JWE-CD, Jefferson’s Welding Encyclopedia CD ............................ 43
TWM, Total Welding Management .......................................................... 44
WHB-X.X, Welding Handbooks ..................................................... 51-52

RESISTANCE WELDING
C1.1M/C1.1, Recommended Practices for Resistance Welding ........ 59
C1.4M/C1.4, Specification for Resistance Welding of Carbon and Low-Alloy Steels .......................................................... 59
C1.5, Specification for the Qualification of Resistance Welding Technicians ........................................................................... 35
C3.9M/C3.9, Specification for Resistance Brazing ............................................. 55
D8.1M, Specification for Automotive Weld Quality — Resistance Spot Welding of Steel ..................................................... 65
INDEXES

PUBLICATIONS SUBJECT INDEX

D8.2M, Specification for Automotive Weld Quality —
Resistance Spot Welding of Aluminum ................................. 65
D8.9M, Test Methods for Evaluating the Resistance Spot
Welding Behavior of Automotive Sheet Steel Materials .......... 65
D17.2/D17.2M, Specification for Resistance Welding for
Aerospace Applications .............................................................. 65
J1.1M/J1.1, Specification for Resistance Welding Controls ...... 59
J1.2M/J1.2, Guide to Installation and Maintenance of
Resistance Welding Machines ................................................... 59
J1.3/J1.3M, Specification for Materials Used in Resistance
Welding Electrodes and Tooling ................................................ 59
RWM, Resistance Welding Manual .......................................... 60
RW1D, Introduction to Resistance Welding Video .................... 60
RW 14, 16, 34, RWMA Bulletins .............................................. 60
QC20, Specification for AWS Certification of Resistance
Welding Technicians ................................................................. 31

ROBOTIC WELDING
A9.5, Guide for Verification and Validation in Computation
Weld Mechanics ........................................................................ 61
D16.2M/16.2, Guide for Components of Robotic and Automatic
Arc Welding Installations ............................................................ 61
D16.3M/16.3, Risk Assessment Guide for Robotic
Arc Welding ............................................................................... 61
D16.4M/D16.4, Specification for the Qualification of
Robotic Arc Welding Personnel .................................................. 36
QC19, Standard for the AWS Certification of Robotic Arc
Welding Personnel .................................................................. 31

SAFETY & HEALTH
D16.1M/D16.1, Specification for Robotic Arc Welding Safety ... 36
EWH-1 thru 14, Effects of Welding on Health, Vol. I through XIV .. 46
F1.1M, Method for Sampling Airborne Particulates Generated by
Welding and Allied Processes ..................................................... 45
F1.2, Laboratory Method for Measuring Fume Generation Rates
and Total Fume Emission of Welding and Allied Processes ....... 45
F1.3, A Sampling Strategy Guide for Evaluating Contaminants
in the Welding Environment ....................................................... 45
F1.6, Guide for Estimating Welding Emissions for EPA and
Ventilation Permit Reporting ..................................................... 45
F2.2, Lens Shade Selector ............................................................ 45
F2.3M, Specification for Use and Performance of Transparent
Welding Curtains and Screens .................................................. 46
F3.2M/F3.2, Ventilation Guide for Weld Fume ......................... 46
F4.1, Safe Practices for the Preparation of Containers and
Piping for Welding, Cutting, and Allied Processes ................. 46
F4.2, Safety Guidelines for Proper Selection of Welding Cables ... 46
Fumes and Gases, Fumes and Gases in the Welding Environment .. 47
Z49.1, Safety in Welding, Cutting, and Allied Processes .......... 45

SHEET METAL
D1.3/D1.3M, Structural Welding Code—Steel ......................... 72
D8.9M, Test Methods for Evaluating the Resistance Spot Welding
Behavior of Automotive Sheet Steel Materials ....................... 65
D9.1/D9.1M, Sheet Metal Welding Code ................................. 79

SHIELDING GASES
A5.32M/A5.32 (ISO 14175 MOD), Welding Consumables –
Gases & Gas Mixtures for Fusion Welding and Allied Processes ... 78

SOLDERING
SHB, Soldering Handbook ......................................................... 56
SHC1, Fundamentals of Soldering Technology ......................... 57
SHC2, Solder Materials .............................................................. 57
SHC3, Substrate Materials .......................................................... 57
SHC4, Fluxes ............................................................................ 57
SHC5, Solder Pastes ................................................................. 57
SHC6, Assembly Processes ....................................................... 57
SHC7, Inspection Techniques for Product Acceptance and
Process Optimization ............................................................... 57
SHC8, Environmental, Safety, and Health ............................... 57
GHSP, Guideline for Hand Soldering Practices ......................... 56
B2.3/B2.3M, Specification for Soldering Procedure and
Performance Qualification .......................................................... 33
C3.11M/C3.11, Specification for Torch Soldering .................... 55
C3.12M/C3.12, Specification for Furnace Soldering .................. 55

STAINLESS STEEL
A4.2M (ISO 8249 MOD), Standard Procedures for Calibrating
Magnetic Instruments to Measure the Delta Ferrite Content of
Austenitic and Duplex Ferritic-Austenitic Stainless Steel
Weld Metal .............................................................................. 76
A5.4/A5.4M, Specification for Stainless Steel Electrodes for
Shielded Metal Arc Welding ..................................................... 77
A5.9/A5.9M (ISO 14343 MOD), Welding Consumables –
Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding
of Stainless and Heat Resisting Steels – Classification ...... 78
A5.22/A5.22M, Specification for Stainless Steel Electrodes for Flux Cored Arc Welding and Stainless Steel Flux Cored Rods for Gas Tungsten Arc Welding ......................................................... 78
D1.6/D1.6M, Structural Welding Code—Stainless Steel ............ 73
d10.4, Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing .................. 69
D10.18M/ D10.18, Guide for Welding Ferritic/Austenitic Duplex Stainless Steel Piping and Tubing ................ 70
D18.1, Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications ....... 58
d18.2, Guide to Weld Discoloration Levels on Inside of Austenitic Stainless Steel Tube ........................................ 58
G2.3M/G2.3, Guide for the Joining of Solid Solution Austenitic Stainless Steels .................................................. 75
WQS, Welding Stainless Steel—Questions and Answers ........ 75

STEEL
D1.1/D1.1M, Structural Welding Code—Steel ........................................ 72
ASTMSW, ASTM Standards for Welding ........................................ 73

STRUCTURAL WELDING
ASTMSW, ASTM Standards for Welding ........................................ 73
D1.1/D1.1M, Structural Welding Code—Steel ........................................ 72
D1.1 CCRM, Code Clinic for Study of AWS D1.1 Structural Welding Code—Steel, Reference Manual .................. 37
D1.1-SWJ-WC, Welded Joint Details Wall Chart .................. 72
D1.2/D1.2M, Structural Welding Code—Aluminum .................. 72
D1.3/D1.3M, Structural Welding Code—Sheet Steel .............. 72
D1.4/D1.4M, Structural Welding Code—Steel Reinforcing Bars .... 72
D1.5M/D1.5-AMD1, Bridge Welding Code .................. 72
D1.6/D1.6M, Structural Welding Code—Stainless Steel ......... 73
D1.7/D1.7M, Guide to Repair and Strengthening of Existing Structures .................................................. 73
D1.8/D1.8M, Structural Welding Code—Seismic Supplement ........ 73
D1.9/D1.9M, Structural Welding Code—Titanium .................. 73

STUD WELDING
D1.1/D1.1M, Structural Welding Code—Steel ........................................ 72
D1.2/D1.2M, Structural Welding Code—Aluminum .................. 72
D1.5M/D1.5-AMD1, Bridge Welding Code .................. 72
D1.6/D1.6M, Structural Welding Code—Stainless Steel ......... 73

SURFACING (see also Thermal Spraying)
A5.13/A5.13M, Specification for Surfacing Electrodes for Shielded Metal Arc Welding ......................................................... 78
A5.21/A5.21M, Specification for Bare Electrodes and Rods for Surfacing ......................................................... 78

SYMBOLS
A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination ........................................ 43

TERMINOLOGY
A3.0M/A3.0, Standard Welding Terms and Definitions .............. 43

TESTING (see Inspection)
THERMAL SPRAYING
C2.16/C2.16M, Guide for Thermal Spray Operator Qualification Programs ......................................................... 35
C2.18, Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites ......................................................... 62
C2.20/ C2.20M, Specification for Thermal Spraying Zinc Anodes on Steel Reinforced Concrete .............. 62
C2.21M/ C2.21, Specification for Thermal Spray Equipment Acceptance Inspection ........................................ 62
C2.23M/ C2.23, Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel ........ 62
C2.25/ C2.25M, Specification for Thermal Spray Feedstock — Wire and Rods ........................................ 62
TSS, Thermal Spraying Practice, Theory and Application ........ 63
TST, ASM Handbook Volume 5A: Thermal Spray Technology ........ 62

THERMITE WELDING
D15.2/D15.2M, Recommended Practices for the Welding of Rails and Related Rail Components for Use by Rail Vehicles ........ 71

TITANIUM
A5.16/A5.16M (ISO 24034 MOD), Specification for Titanium and Titanium—Alloy Welding Electrodes and Rods .............. 78
D1.9/D1.9M, Structural Welding Code—Titanium .................. 73
D10.6/D10.6M, Recommended Practices for Gas Tungsten Arc Welding of Titanium Piping and Tubing .............. 69
G2.4/G2.4M, Guide for the Fusion Welding of Titanium and Titanium Alloys ............................................... 75
INDEXES

PUBLICATIONS SUBJECT INDEX

UNDERWATER WELDING (see Marine)

WELDING CURTAINS AND SCREENS
F2.3M, Specification for Use and Performance of Transparent Welding Curtains and Screens ................................................................. 46

ZINC COATINGS
WZC, Welding Zinc-Coated Steels .......................................................... 47

ZIRCONIUM
A5.24/ A5.24M, Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods ...................................................... 78
G2.5/ G2.5M, Guide for the Fusion Welding of Zirconium and Zirconium Alloys ............................................................... 75

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<table>
<thead>
<tr>
<th>INDEXES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLICATIONS CODE NAME INDEX</td>
</tr>
</tbody>
</table>

| A1.1—Metric Practice Guide for the Welding Industry | 43 |
| A2.1—Welding Symbol Charts | 43 |
| A2.4—Standard Symbols for Welding, Brazing, and Nondestructive Examination | 43 |
| A3.0M/A3.0—Standard Welding Terms and Definitions | 43 |
| A3.1—Master Chart of Welding and Joining Processes | 43, 63 |
| A4.2M (ISO 8249 MOD)—Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metals | 76 |
| A4.3—Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding | 76 |
| A4.4M—Standard Procedures for Determination of Moisture Content of Welding Fluxes and Welding Electrode Flux Coverings | 76 |
| A4.5M/A4.5 (ISO 15792-3 MOD)—Standard Methods for Classification Testing of Positional Capacity and Root Penetration of Welding Consumables in a Fillet Weld | 76 |
| A5.01M/A5.01 (ISO 14344 MOD)—Welding Consumables—Procurement of Filler Metals and Fluxes | 76 |
| A5.02M/A5.02—Specification for Filler Metal Standard Sizes, Packaging, and Physical Attributes | 76 |
| A5.1/A5.1M—Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding | 77 |
| A5.2/A5.2M—Specification for Carbon and Low-Alloy Steel Welding Electrodes and Rods for Oxyfuel Gas Welding | 77 |
| A5.3/A5.3M—Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding | 77 |
| A5.4/A5.4M—Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding | 77 |
| A5.5/A5.5M—Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding | 78 |
| A5.6/A5.6M—Specification for Copper and Copper-Alloy Electrodes for Shielded Metal Arc Welding | 78 |
| A5.7/A5.7M—Specification for Copper and Copper-Alloy Bare Welding Electrodes and Rods | 78 |
| A5.8M/A5.8—Specification for Filler Metals for Brazing and Braze Welding | 78 |
| A5.9/A5.9M (ISO 14343 MOD)—Welding Consumables—Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels—Classification | 78 |
| A5.10/A5.10M (ISO 18273 MOD)—Welding Consumables—Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys—Classification | 78 |
| A5.11/A5.11M—Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding | 78 |
| A5.12M/A5.12 (ISO 6848 MOD)—Specification for Tungsten and Oxide Dispersed Tungsten Electrodes for Arc Welding and Cutting | 78 |
| A5.13/A5.13M—Specification for Surfacing Electrodes for Shielded Metal Arc Welding | 78 |
| A5.14/A5.14M—Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods | 78 |
| A5.15—Specification for Welding Electrodes and Rods for Cast Iron | 78 |
| A5.16/A5.16M (ISO 24034 MOD)—Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods | 78 |
| A5.17/A5.17M—Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding | 78 |
| A5.18/A5.18M—Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding | 78 |
| A5.19—Specification for Magnesium Alloy Welding Electrodes and Rods | 78 |
| A5.20/A5.20M—Specification for Carbon Steel Electrodes for Flux Cored Arc Welding | 78 |
| A5.21/A5.21M—Specification for Bare Electrodes and Rods for Surfacing | 78 |
| A5.22/A5.22M—Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods | 78 |
| A5.23/A5.23M—Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding | 78 |
| A5.24/A5.24M—Specification for Zirconium and Zirconium-Alloy Welding Electrodes and Rods | 78 |
| A5.25/A5.25M—Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding | 78 |
| A5.26/A5.26M—Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding | 78 |
| A5.28/A5.28M—Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Metal Arc Welding | 78 |
| A5.29/A5.29M—Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding | 78 |
| A5.30/A5.30M—Specification for Consumable Inserts | 78 |
| A5.31M/A5.31—Specification for Fluxes for Brazing and Braze Welding | 78 |
| A5.32M/A5.32 (ISO 14175 MOD)—Welding Consumables—Gases & Gas Mixtures for Fusion Welding and Allied Processes | 78 |
| A5.33/A5.34M—Specification for Nickel-Alloy Flux Cored and Metal Cored Welding Electrodes | 78 |
INDEXES

PUBLICATIONS CODE NAME INDEX

A5.35/A5.35M—Specification for Covered Electrodes for Underwater Wet Shielded Metal Arc Welding .................................................. 78
A5.39/A5.39M, Specification for Flux and Electrode Combinations for Submerged Arc and Electroslag Joining and Surfacing of Stainless Steel and Nickel Alloys .................................................................... 78
A9.5—Guide for Verification and Validation in Computation焊机机械性能 ........................................................................... 61
B1.10M/B1.10—Guide for the Nondestructive Examination of Welds…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...…………………...……
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