AWS B5.16:2006
An American National Standard

Specification for the Qualification of Welding Engineers

American Welding Society

Approved American National Standard
ANSI

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Specification for the Qualification of Welding Engineers

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Prepared by the
American Welding Society (AWS) B5C Subcommittee on Qualification of Welding Engineers

Under the Direction of the
AWS Personnel and Facility Qualification Committee

Approved by the
AWS Board of Directors

Abstract

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.

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Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the Managing Director, Technical Services Division, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126 (see Annex B). With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. However, such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS Personnel and Facilities Committee. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are required and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS Personnel and Facilities Committee and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS Personnel and Facilities Committee to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Foreword

This foreword is not a part of AWS B5.16:2006, *Specification for the Qualification of Welding Engineers*, but is included for informational purposes only.

The Qualification and Certification Committee of the American Welding Society was formed in 1973. In 1996, it was divided into two committees. The Personnel and Facility Qualification Committee is now responsible for creating American National Standards for welding personnel and welding facility qualification requirements. The AWS Certification Committee is now responsible for creating certification programs from these and other recognized standards.

This is the second edition of this specification. Several minor editorial changes were made. This specification for the qualification of welding engineers was developed to provide a qualification basis which defines minimum requirements for a welding engineer to demonstrate competence through a combination of education, experience, and examination.

The welding engineer is a person who determines weld requirements which may be governed under a specific code, contract, drawing, specification, purchase order, or other documents. The welding engineer either prepares or reviews written instructions for the production of welded joints. The welding engineer must be thoroughly familiar with various codes, specifications, other standards, base materials, filler materials, heat treatment, mechanical properties, welding and joining processes, procedures, weld joint design, welding equipment, thermal cutting, inspection methods, acceptance criteria, tests, welding qualification requirements, fabrication tolerances, and other aspects of fabrication and assembly. The welding engineer shall also prepare and produce reports which accurately reflect professional judgment. For the welding engineer to be effective, the activities they perform must be consistent with specified requirements, technical and ethical principles. The welding engineer must be able to work with management representatives, inspection personnel, welders and support crafts, and should be able to understand the role of each in the development of weldments.

It is recommended that an individual pursue certification as a Welding Engineer by a recognized authorized body. Certification is defined as *the act of determining, verifying, and attesting in writing to the qualification of personnel in accordance with specified requirements*.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS B5 Committee on Qualification, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

Official interpretations of any of the technical requirements of this standard may be obtained by sending a request, in writing, to the Managing Director, Technical Services Division, American Welding Society (see Annex B). A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

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Specification for the Qualification of Welding Engineers

1. Scope

1.1 This specification establishes qualification requirements for Welding Engineers. It describes how qualifications are determined, and the practice by which qualification may be attained and maintained.

1.2 The user of this specification will evaluate the qualifications of each individual, and provide examinations to test the individual's knowledge in engineering skills and knowledge as well as their ability to apply the principles of welding engineering.

1.3 This specification is intended to supplement the minimum requirements of employers, codes, other standards, or documents and shall not be construed as a preemption of the employer's responsibility for the work or for the performance of the work.

1.4 It shall be the responsibility of employers to determine that their employee, who, having qualified as a Welding Engineer, is capable of performing the specific duties involved in their career assignments.

1.5 As used in this specification, the word ***shall*** denotes a requirement, the word ***should*** denotes a guideline, and the word ***may*** denotes a choice.

2. Referenced Documents

1. AWS A3.0, *Standard Welding Terms and Definitions*.[1]

3. Qualification

3.1 Welding Engineer. A person with the demonstrated education, experience, and knowledge in accordance with Clauses 6, 7, and 9 of this specification and who successfully passes the required examinations, shall be considered qualified as a Welding Engineer.

3.1.1 The title of Welding Engineer, as specified herein, **DOES NOT** imply the status of a registered Professional Engineer (P.E.) under the laws of any state or other governmental entity.

PRECAUTION: While the Welding Engineer has established excellent credentials, qualification to this specification alone may not legally qualify the engineer to provide technical services to the public. Contract documents, and building or jurisdiction laws may require technical services to be performed under the direction and responsibility of others such as a registered Professional Engineer. The Welding Engineer designation **DOES NOT** imply the status of a registered Professional Engineer (P.E.) under the laws of any state or other governmental entity.

4. Terms and Definitions

Terms used in this standard are defined below. All other terms used herein are defined by AWS A3.0, *Standard Welding Terms and Definitions*.

Committee. The Personnel and Facility Qualification Committee of the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

contact hours. One contact hour has been defined as 50 minutes of classroom time (lecture or lab hours).

continuing education unit (CEU). One CEU is defined as 10 contact hours.

nondestructive examination (NDE). The act of determining the suitability of some material or component for its intended purpose using techniques that do not affect its serviceability.

[1] AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

qualification. Process of demonstrating whether an entity or individual is capable of fulfilling specified requirements.

5. Functions

The Welding Engineer shall be capable of directing those operations associated with weldments and other types of applied joints that are completed in accordance with the appropriate contract documents, codes, and other standards to produce a satisfactory product. The welding engineer's activities begin before production welding, continue through the production process and end when the production process is complete.

Each employer shall be responsible for defining the specific duties of a welding engineer in the place of employment.

The Welding Engineer shall be able to demonstrate that he/she can perform the activities defined in this standard.

5.1 Activities. The detailed activities of a Welding Engineer include the following (note: Demonstration of the required knowledge related to these activities is addressed in Clauses 6, 7, and 9):

5.1.1 Safety. The Welding Engineer shall be knowledgeable of safety practices as they pertain to welding, cutting, and joining processes.

5.1.2 Design. The Welding Engineer shall be capable of applying generally accepted engineering principles to the design of welded structures or structures manufactured using other related processes. This includes meeting specific service requirements as well as compliance to applicable codes or specifications.

5.1.3 Materials and Welding/Joining Metallurgy. The Welding Engineer shall possess a practical knowledge of ferrous and nonferrous materials including: carbon steel, various types of alloy steels, stainless steels, nickel and nickel alloys, aluminum and aluminum alloys, copper and copper alloys, titanium and titanium alloys, ceramics, and plastics.

The Welding Engineer shall possess a knowledge of the welding metallurgy for ferrous and nonferrous materials. This includes an understanding of melting, solidification, solid state transformations, thermal strains, and residual stress phenomena. The Welding Engineer shall be able to demonstrate a practical knowledge of how the different welding processes and pre- and post-welding heat treating processes affect the metallurgy of ferrous and nonferrous materials. This knowledge shall also include an understanding of oxidation-reduction reactions.

5.1.4 Welding, Cutting, and Joining Processes. The Welding Engineer shall demonstrate a working knowledge of arc welding, resistance welding, brazing, and soldering. The Welding Engineer shall demonstrate working knowledge of oxyfuel gas cutting, arc cutting, and high energy beam cutting. The Welding Engineer shall demonstrate a working knowledge of solid state welding, high energy beam welding, and processes appropriate for nonmetallic materials.

5.1.5 Quality Assurance, Quality Control, and Welding/Joining Economics. The Welding Engineer shall understand quality assurance systems and be able to participate in the implementation of quality assurance programs.

The Welding Engineer shall be knowledgeable in all aspects of quality control. The Welding Engineer shall understand procedure and welder performance qualification, including destructive and nondestructive testing. The Welding Engineer shall be capable of performing visual inspection of welds and specifying the appropriate nondestructive examination (NDE) methods for a particular weldment. The Welding Engineer shall understand the advantages and limitations of NDE. The Welding Engineer shall be familiar with the qualification requirements of NDE personnel.

The Welding Engineer shall have a practical knowledge of manufacturing systems, including material control, production scheduling, and quality assurance. The Welding Engineer shall be able to evaluate the relative cost effectiveness of competitive welding/joining processes.

5.1.6 Mathematics. The Welding Engineer shall have a working knowledge of algebra, trigonometry, solid and plane geometry, calculus, and statistical methods (see 8.1.1).

5.1.7 Physics. The Welding Engineer shall have a working knowledge of mechanics, heat, electricity, electronic systems, and magnetism. The engineer shall demonstrate competence in understanding the mechanics of arc plasmas, the dynamics of heat transfer, and fluid mechanics (see 8.1.2).

5.1.8 Chemistry. The Welding Engineer shall have a working knowledge of physical, organic and inorganic chemistry (see 8.1.3).

6. Education and Experience Qualification Requirements

6.1 Each individual for qualification as a Welding Engineer shall possess one of the following combinations of education and relevant experience to be eligible for the

Welding Engineer examination. The experience requirements are further defined in Clause 7.

6.1.1 Individuals with a Baccalaureate of Science (B.Sc.) degree in engineering shall have a minimum of one (1) year of related experience.

6.1.2 Individuals with a Baccalaureate of Science (B.Sc.) degree in engineering technology shall have a minimum of two (2) years of related experience.

6.1.3 Individuals with other related Baccalaureate of Science (B.Sc.) degrees shall have a minimum of five (5) years of related experience.

6.1.4 Individuals with an Associate in Applied Science (A.A.S.) degree shall have a minimum of ten (10) years of related experience.

6.1.5 Individuals who have successfully completed high school or an equivalent program shall have a minimum fifteen (15) years of related experience.

7. Definition of Experience

7.1 Experience as required in 6.1 shall be defined as activities in one or more of the following areas:

7.1.1 Manufacturing. Experience shall consist of the design, application, or operation of welding process lines or cells for the manufacture of welded products such as automobiles, appliances, welded pipe, or other welded standard products.

7.1.2 Fabrication. Experience shall consist of the design, application, or operation of welding facilities that fabricate welded products. Fabricated products may be covered by national, customer, or internal standards or specifications.

7.1.3 Construction. Experience shall consist of design on welding construction of projects such as buildings, pipelines, ships, plants and power generation facilities.

7.1.4 Research and Development. Experience shall consist of research and development to enhance welded products or processes, welding materials, manufacturing, fabrication, field erection of welded products, or the design of welding manufacturing systems.

7.1.5 Training. Experience shall consist of instructing courses in various welding topics or related technologies.

7.2 As an alternate to the qualification requirements of this specification, individuals possessing a State Professional Engineering License in Welding Engineering shall be qualified in accordance with this specification without further evaluation of education, experience, or examination.

7.3 Individuals possessing a diploma indicating successful completion of the requirements for either the International Welding Engineer, IIW, or European Welding Engineer, EWF, shall have a minimum of one (1) year of experience (may be obtained before, or after the diploma) to be eligible for the Welding Engineer examination.

7.4 Other organizations may petition the Committee for acceptance as in 7.2 and 7.3.

8. Body of Knowledge

8.1 Basic Sciences

8.1.1 Mathematics. Simple calculations (multiple choice); special functions (exp, log); trigonometric functions (sin, cos, tan, cot, sec, csc, degrees, radians); algebraic equations (linear, quadratic, polynomial); graphs and equations (slope, intercept, roots, derivatives, minimum, maximum, interpolation, and extrapolation); geometry (common geometric shapes); hyperbola, parabola; complex numbers; calculus (fundamentals of differential equations); statistics (population and samples: normal distribution, mean, standard deviation, variance; simple correlation: linear regression via least squares method, r^2 correlation).

8.1.2 Physics. Unit conversion (dimension, mass, temperature, time, energy, power); mass, weight, volume, density; force, energy, work done, power; stress, strain, Hooke's Law (elasticity); moment and momentum; temperature, heat, temperature measurement, thermocouples, pyrometers; thermal properties of materials (thermal conductivity, thermal expansion, thermal stress and strain).

8.1.3 Chemistry. Symbols (elements and inorganic compounds—gases, fluxes, etc.); molecular weight and stoichiometry; acids and bases; balance chemical equations; gas combustion reactions (chemical heat generation) and oxidation-reduction reactions; ideal gas law (pressure, volume, temperature); mass balance (as in E7018 coating decomposition to gas, slag and metal); bulk and chemical analysis methodologies); reactivity, toxicity, environmental effect, disposal.

8.2 Applied Sciences

8.2.1 Strength of Materials. Load, deformation (elastic and plastic, buckling), stress-strain, Young's Modulus, shear modulus, stress-strain curve (yield stress, ultimate tensile stress, elongation), tensile stress and shear stress computation; welded member cross-section

effect; mechanical testing (tensile, bend, fracture toughness, hardness, creep, and fatigue) and data interpretation; Law of Conservation of Energy/Momentum; stress analysis; typical engineering material properties.

8.2.2 Heat Transfer and Fluid Mechanics. Heat conduction, convection, and radiation, thermal conductivity and diffusivity, heat transfer coefficients of engineering materials, Fourier's Law; heating rate and cooling rate; industrial heating methods and power consumption, gas flow rates; laminar and turbulent flow (Reynold's Number), dew point and relative humidity, pressure and regulators; venturi effect and gas velocity calculation; atmospheric pressure and hyperbaric conditions; vacuum equipment and measurements.

8.2.3 Electricity. Current, voltage, resistance, impedance, and circuits; Ohm's Law; Kirchoff's Law; resistance loss and current rectification; power generation; AC/DC, polarity; power factor; electromagnetic properties, right-hand rule; current and voltage measurements (devices and principles).

8.3 Welding Related Disciplines

8.3.1 NDE/Weld Discontinuities. NDE processes (radiographic, ultrasonic, magnetic particle, liquid penetrant, eddy current, etc.—characteristics, advantages, and limitations). NDE symbols.

8.3.2 Welding Heat Sources and Arc Physics. Power source static and dynamic characteristics (open circuit voltage and short circuiting current, slope); differences between CC and CV designs (principle of self-adjusting); welding arc characteristics (current and voltage relationship, arc length effect); electron emission (ionization potential, work function, electrode material, shielding gas, arc stability); arc temperature and degree of ionization (shielding gas influence); magnetic arc blow (work lead location and condition); Lorentz Force (effect on droplet detachment and on adjacent power cables); shielding gas drag force (effect on droplet detachment and metal transfer mode) weld penetration and width for different shielding gases.

8.3.3 Welding Processes and Controls. Arc welding processes (SMAW, GMAW, FCAW, GTAW, SAW, PAW); resistance welding processes (RW, high frequency RW), high energy density welding processes (LBW, EBW); cutting processes (OFC, CAC, and PAC); surfacing processing (SW, THSP); solid-state welding processes (FRW, FW).

8.3.4 Welding and Joining Metallurgy. Crystal structure of metals (FCC, BCC, HCP, unit cells, lattice parameter, c/a ratio, atom positions, interstitial positions); melting, and solidification, phase transformations and phase diagrams (eutectic, eutectoid, peritectic and monotectic, lever rule calculation) metallurgy and weldability of typical engineering materials (low carbon structural steels, cast irons, stainless steels, nickel alloys, aluminum alloys, titanium alloys, etc.) microstructure (e.g., ferrous alloys—grain boundary ferrite, acicular ferrite, bainite, martensite, austenite, delta ferrite, etc.) and mechanical properties; carbon equivalent (CE_{IIW}, P_{cm}, expressions, alloying content and carbon content effect); hydrogen assisted cracking (heat-affected zone cracking, cold cracking) base metal matching (e.g., electrodes with high strength steels); solidification cracking (segregation of impurity atoms, shrinkage cracking, lamellar tearing); delta ferrite in stainless consumables, specifications for consumables (categories; all position, rutile, basic); flux-metal reactions (oxygen and sulfur control in weld pool); typical temperature range of a heat source; temperature distribution in a weldment; HAZ formation; multipass thermal experience, reheated weld metal properties; weld macro and micro-graph interpretation; solidification profile and preferred grain orientation (epitaxial growth); origin of weld ripples; special attributes of base metal (as-cast structure, deformation texture, oxide on flame-cut surfaces); thermal treatments (preheat, postheat, interpass influence on weld cooling rate and residual stress distribution); solid-state transformations in welds (different forms of ferrite, bainite, and martensite, sigma phase in stainless steels, Guinier-Preston type precipitates zones and aging in aluminum alloys); corrosion (sensitization in stainless steel welds, stress corrosion cracking in welds).

8.3.5 Weld Design. Structural fabrication requirements, sectional properties, stress gradient; stress triaxiality, weld symbols, hardness and microhardness (e.g., across a weld cross section); tensile properties, ductility, toughness, fillet break test (influence of second phase and porosity), ductile fracture, brittle fracture, fatigue (initiation, propagation, failure, high-cycle, low-cycle), temperature and strain rate effect.

8.3.6 Brazing and Soldering. Characteristics of brazing and soldering, fluxes and substrates, capillary action, wetting and spreading, contact angle, joint clearance, viscosity, liquidus and solidus, flow of molten filler in horizontal and vertical joints (maximum penetration and rate), filler metal systems (Sn-Pb solders, Ni and Cu based alloys, Ag-Cu based brazing alloys), and intermetallic compound formation.

8.3.7 Safety. Recognize health hazards relating to welding, (fumes, toxic gases, noise, radiation). Recognize safety hazards, (electric shock, compressed gases, fire, welding in a confined space, welding on containers and piping, moving equipment). Recognize precautions to avoid injury, and possess a working knowledge of safety and fire codes.

9. Examination Requirements

Individuals seeking qualification as a Welding Engineer shall successfully complete the following examinations, drawn from the Body of Knowledge given in Clause 8, except as permitted by 7.2, 7.3, and 7.4 (when applicable):

9.1 Basic Science Fundamental Examination. The individual shall pass an examination without references consisting of questions from each of the three Basic Science topics:

Topic	Percent of Examination Questions
Mathematics	25%
Physics	50%
Chemistry	25%
Total	100%

9.2 Applied Science Fundamental Examination. The individual shall pass an examination without references consisting of questions from each of the three Applied Science topics:

Topic	Percent of Examination Questions
Strength of Materials	40%
Heat Transfer and Fluid Mechanics	30%
Electricity	30%
Total	100%

9.3 Welding Related Disciplines Examination. The individual shall pass an examination with references on the application of engineering concepts in the areas of:

Topic	Percent of Examination Questions
NDE/Weld Discontinuities	10%
Welding Heat Sources and Arc Physics	20%
Welding Processes and Controls	20%
Welding and Joining Metallurgy	20%
Weld Design	20%
Brazing and Soldering	5%
Safety	5%
Total	100%

9.4 Practical Welding and Related Applications Examination. The individual shall pass an examination with references on the application of welding engineering concepts in the areas of welding safety, weldment design, welding metallurgy, materials, welding process selection, NDE including visual weld inspection, quality assurance, quality control in accordance with codes, specifications, other standards, and/or drawings.

9.5 Passing Requirements. Each of the four examinations shall not have an individual score less than sixty percent (60%). Each individual examination shall be weighted and the resulting composite score from sections shall not be less than seventy percent (70%).

1. Basic Science Examination:

   Raw Score $\times$ 0.15 = Weighted Score$_1$

2. Applied Science Examination:

   Raw Score $\times$ 0.15 = Weighted Score$_2$

3. Welding Related Disciplines Examination:

   Raw Score $\times$ 0.30 = Weighted Score$_3$

4. Practical Examination (combined exercise):

   Raw Score $\times$ 0.40 = Weighted Score$_4$

Weighted Score$_1$ + Weighted Score$_2$ + Weighted Score$_3$ + Weighted Score$_4$ = Composite Score

9.6 The Basic and Applied Science portion of the examination requirements described in 9.5 may be complied with by successful completion of the Engineering Fundamentals Examination, (formerly the E.I.T. examination). This examination shall be administered by the State Board of Engineering or other governmental entity. Use 85 $\times$ 0.30 in calculating the individual's score for the Basic Science and the Applied Science Examinations.

0.30 (85) + Weighted Score$_3$ + Weighted Score$_4$ = Composite Score

PRECAUTION: While the Welding Engineer has established excellent credentials, qualification to this specification alone may not legally qualify the engineer to provide technical services to the public. Contract documents, and building or jurisdiction laws may require technical services to be performed under the direction and responsibility of others such as a Registered Professional Engineer. The Welding Engineer designation **DOES NOT** imply the status of a registered Professional Engineer (P.E.) under the laws of any state or other governmental entity.

10. Maintenance of Qualification

The Welding Engineer shall maintain the qualification through continued education. This education shall be restricted to the functions as defined in Clause 5. The Welding Engineer shall demonstrate successful completion of continued education every five (5) years to maintain the qualification. Continued education shall relate to the functions in Clause 5. and shall be equivalent to 80 contact hours in the five year period or combination of contact hours plus continuing education units totaling 80 contact hours.

Annex A
Suggested Reference List

This annex is not a part of AWS B5.16:2006: *Specification for the Qualification of Welding Engineers,* but is included for informational purposes only.

The following references have been identified as useful study guides for the Body of Knowledge covered in Clause 8 of this specification. This does not preclude the use of other potentially beneficial references.

Reference Title	Author	Publisher
ANSI Z49.1 Safety in Welding, Cutting, and Allied Processes		AWS
Applied Fluid Mechanics, 4th Ed.	Mott	Merrill Publishing Company
ASM Handbook Vol. 17, NDE		ASM
ASM Handbook Vol. 6 Welding/Brazing 10th Ed.		ASM
AWS D1.1 Structural Welding Code—Steel		AWS
Design of Weldments	Omer W. Blodgett	The James F. Lincoln Arc Welding Foundation
Engineer in Training Manual		
Essentials of Engineering Economics, 2nd Ed.	Riggs & West	McGraw Hill
Fracture & Fatigue Control in Structures, Application of Fracture Mechanics	John M. Barson & Stanley T. Rolfe	Prentice Hall Second Edition, 1987
Fundamentals of Engineering: The Most Effective FE/EIT Review	Merle C. Potter	Great Lakes Press
Fundamentals of Welding Technology, Modules 1–19		Gooderham Centre for Industrial Learning
Handbook of Arc Welding		James F. Lincoln Arc Welding Foundation
Introduction to the Practice of Statistics, ISBN: 0 7167 2250 X	Moore & McCabe	Freeman
Introductory Physical Metallurgy of Welding	Easterling	Butterworths
Introductory Welding Metallurgy		AWS
Manufacturing, Engineering & Technology, ISBN: 0 201 538460	Serope and Kalpakjian	Addison Wesley
Mark's Standard Handbook for Mechanical Engineers	Avallone and Baumeister	McGraw-Hill
Mechanical Metallurgy	G. Dieter	McGraw Hill

Reference Title	Author	Publisher
Metals and How to Weld Them		James F. Lincoln Arc Welding Foundation, Second Edition, 1990
Modern Welding Technology, 4th Ed.	H. Cary	Prentice Hall
NFPA 51B Standard for Fire Prevention During Welding, Cutting, and Other Hot Work		National Fire Protection Association
Occupational Safety and Health Administration (OSHA). Code of Federal Regulations, Title 29 Labor, Part 1910 Subpart Q—Welding, Cutting, and Brazing		U.S. Government Printing Office
Occupational Safety and Health Administration (OSHA). Code of Federal Regulations, Title 29 Labor, Part 1910.1200—Hazard Communication		U.S. Government Printing Office
Occupational Safety and Health Administration (OSHA). Code of Federal Regulations, Title 29 Labor, Part 1926 Subpart J—Welding and Cutting		U.S. Government Printing Office
Physics of Arc Welding	J. Lancaster	Pergamon
Product Design for Manufacture and Assembly, ISBN: 0 8247 9176 2	Boothroyd, Dewhurst, & Knight	Marcel Dekker
Quality Control, 5th Ed.	Besterfield	Prentice Hall
Robots & Manufacturing Automation	Asfahl	John Wiley
Stainless Steel	R.A. Lula	ASM International, 1986
Statics & Strength of Materials, 3rd Edition, ISBN: 0-13-453201-5	Morrow	Prentice Hall
Statics & Strength of Materials: A Parallel Approach to Understanding Structures	Lawrence J. Wolf	Merrill Publishing Company
Weld IT CD, Computer Influence for Welding Personnel		Gooderham Centre for Industrial Learning
Weldability of Steels, 4th Edition, ISBN: 1-58145-430-9	R. D. Stout	Welding Research Council
Welding Aluminum: Theory and Practice		The Aluminum Association, Second Edition, June 1991
Welding Design, Modules 30-39		Gooderham Centre for Industrial Learning
Welding Encyclopedia	Jefferson	AWS
Welding Handbook Vols. 1, 2, 3, 4, 8th Ed.		AWS
Welding Metallurgy	Sindo Kou	John Wiley & Sons
Welding Metallurgy	Linnert	AWS
Welding Metallurgy	J. Lancaster	Pergamon
Welding Metallurgy, Modules 8, 9, 12, 20–23		Gooderham Centre for Industrial Learning

Annex B

Guidelines for the Preparation of Technical Inquiries

This annex is not a part of AWS B5.16:2006: *Specification for the Qualification of Welding Engineers,* but is included for informational purposes only.

B1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

B2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

B2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry along with the edition of the standard that contains the provision(s) the inquirer is addressing.

B2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

B2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

B2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what inquirer seeks.

B3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official

interpretation of the Society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

B4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

B5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning AWS standards should be limited to questions of a general nature or to matters directly related to the use of the standard. The AWS Board of Directors' policy requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be obtained only through a written request. Headquarters staff cannot provide consulting services. However, the staff can refer a caller to any of those consultants whose names are on file at AWS Headquarters.

B6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest