

Department of Education
SPTVE
Shielded Metal Arc Welding
(SMAW) 9
International Welding Codes and
Standards
Quarter 2: Week 4 Module



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EXPECTATIONS

At the end of the module, you should be able to:

1. familiarize with the different international welding codes and standard;.
2. compare the different international welding codes and standards; and
3. value the importance of welding codes and standards.



PRE-TEST

Directions: Read the statements carefully and choose the letter of the correct answer. Write your answer on a separate sheet of paper.

1. This publishes many documents addressing the use and quality control of welding.
A. API B. ASME C. ASNT D. AWS
2. This is responsible for the development of the Boiler and Pressure Vessel Code, which contains eleven sections and covers the design, construction, and inspection of boilers and pressure vessels.
A. API B. ASME C. ASNT D. AWS
3. This publishes many documents relating to petroleum production.
A. API B. ASME C. ASNT D. AWS
4. This provides recommended educational, experience and training for the non-destructive testing methods.
A. API B. ASME C. ASNT D. AWS
5. These documents include such general subjects as Welding Definitions and Symbols, Classification of Filler Metals, Qualification and Testing, Welding Processes, Welding Applications, and Safety.
A. API B. ASME C. ASNT D. AWS
6. Welding codes are developed by a variety of organizations to set requirements, which is not included below:
A. experiment B. inspection C. repair D. testing
7. Which of the following is not the purpose of welding codes and standards?
A. painting works
B. to develop fabrications
C. develop best practices in welding
D. to improve welder skills and quality
8. The Department of Defense (DOD) has adopted many of the codes and used Them as a basis to develop their code known as:
A. API B. ASME C. AWS D. Mil-Specs
9. This standard provides minimum requirements for maintaining the integrity of welded or riveted, atmospheric pressure, above ground storage tanks after they have been placed in the service.
A. API 570 B. API 620 C. API 653 D. API 1104
10. AWS sets welding codes for:
A. standardization C. performance standard
B. piping test code D. certifying welding inspectors



LOOKING BACK

Directions: Match column A with column B and choose the letter of the correct answer. Write your answer in a separate sheet of paper.

Column A

1. It is used to control the shape of the weld puddle and the amount of penetration.
2. This is the rate at which the electrode moves along the work.
3. It measures the amperes, or amps for optimum performance.
4. It is the distance from the tip of the electrode core wire to the weld puddle.
5. It tells the type, position, preparation of the joint, the ability of the electrode to carry high current values, etc.

Column B

- A. electrode size
- B. arc length
- C. current
- D. travel speed
- E. electrode angle



BRIEF INTRODUCTION

Welding codes are developed by a variety of organizations to set requirements for:

- inspection
- testing
- repair
- approved materials
- fabrication
- design specifications
- welding itself

The purpose of each of the welding codes is to have a uniform way to approach welding that reflects the best practices developed and proven to work overtime. They have the effect of improving welder skill, equipment, and processes. The result is growth in the profession when it comes to skill, quality, and welder efficiency.

The Department of Defense (DOD) has adopted many of these codes or used them as a basis to develop their own codes known as Mil-Specs. These codes are recognized by the American National Standards Institute (ANSI).

Four groups set the foundation for the codes. Each group sets and adapts codes that pertain to their area of interest. Contracts may specify one or the other code.

- American Welding Society (AWS)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)

- American Society for Non-Destructive Testing (ASNT)

All these organizations have multiple specific codes for various types of construction, processes, and/or materials. Design specifications and approved materials are included in these codes.

The following are some of the codes:

American Petroleum Institute (API)

The API or American Petroleum Institute is a national trade association that speaks for all aspects of the U.S. oil and natural gas industry.

Welding codes issued are related to tasks such as pipeline inspection, storage tanks and pipeline construction.

❖ **API 570: Piping Inspection**

Sets requirements for the inspection, alteration, repair, and re-rating of in-service piping systems. It was created for the chemical process and petroleum refining industries. It is also broadly applied to piping systems. The code was written for groups that have access to or maintain an authorized inspection agency, a repair group, and technically qualified piping engineers, inspectors, and examiners.

❖ **API 620: Welded Steel Tanks for Storage**

This code standard is for the design, material, erection, fabrication and testing requirements for vertical, cylindrical, above ground, closed and open-top, welded steel storage tanks in various sizes and capacities for internal pressures approximating atmospheric pressure (internal pressure not exceeding the weight of the roof plates), but a higher internal pressure is permitted when additional requirements are met.

This standard applies only to tanks whose entire bottom is uniformly supported and to tanks in non-refrigerated service that have a maximum operating temperature of 90°C (200°F).

❖ **API 653: Tank Reconstruction, Alteration, Repair, and Inspection**

This standard covers carbon and low alloy steel tanks built to API Standard 650 and its predecessor API Specification 12C. API 653 provides minimum requirements for maintaining the integrity of welded or riveted, atmospheric pressure, above ground storage tanks after they have been placed in service. It covers the maintenance inspection, repair, alteration, relocation, and reconstruction of such tanks. The scope of this publication is limited to the tank foundation, bottom, shell, structure, roof, attached appurtenances, and nozzles to the face of the first flange, first threaded joint, or first welding-end connection. This standard employs the principles of API 650; however, storage tank owner/operators may apply this standard to any steel tank constructed in accordance with a tank specification.

❖ **API 1104 Welding of Pipelines and Related Facilities**

This standard covers the arc and gas welding of fillet, butt, arc and gas, and socket welds in carbon and low-alloy steel piping used in the compression, pumping, and transmission of crude petroleum, petroleum products, fuel gases, carbon dioxide, and nitrogen, and where applicable, covers welding on distribution systems.

It applies to both new construction and in-service welding. The welding may be done by a shielded metal-arc welding, submerged arc welding, gas tungsten-arc welding, gas metal-arc welding, flux-cored arc welding, plasma arc welding, oxyacetylene welding, or flash butt welding process or by a

combination of these processes using a manual, semi-automatic, or automatic welding technique or a combination of these techniques, The welds may be produced by position or roll welding or by a combination of position and roll welding.

This standard also covers the procedures for radiographic, magnetic particle, liquid penetrant, and ultrasonic testing as well as the acceptance standards to be applied to production welds tested to destruction or inspected by radiographic, magnetic particle, liquid penetrant, ultrasonic, and visual testing methods.

American Welding Society (AWS)

The American Welding Society (AWS) has a mission to advance the science, technology and application of welding and allied joining and cutting processes, including brazing, soldering, and thermal spraying. The organization has more than 350 welding codes, procedures, practices and standards. The standard D1.1 (see below) is the referenced more than any other code when it comes to steel welding.

The AWS sets welding codes for the following:

- Certifying welding inspectors
- Aluminum welding (gas arc welding, gas tungsten welding, plasma arc welding)
- Sheet Steel welding: Applications and capacities for sheet metal
- Aerospace: fusion welding materials and processes
- Construction: bridge highway welding codes
- Structural Steel Welding: All types of welding processes

❖ AWS D1.1: Fabricating and Erecting Welded Steel Structures

This code contains the requirements for fabricating and erecting welded steel structures. This code applies to steels with a thickness of 1/8 inch (3.2mm) or more. When this code is specified in a contract, most of the provisions are mandatory. Optional provisions and examples are shown in an annex included within this code.

The code is primarily applied to support structures and buildings, such as erecting and fabricating a structure that is welded.

❖ AWS D1.2: This is the Structural Welding Code-Aluminum

The welding requirements are applicable to any type of welded aluminum alloy structure. This code is appropriate for use in fabrication of supporting structures and appurtenances. It is not intended to supplant codes developed for use in specialized fabrication such as the ASME Boiler and Pressure Vessel Code, aerospace codes, or military codes.

❖ AWS D1.3: Structural Steel Welding Code

This is the Structural Welding Code-Sheet Steel. This code covers the arc welding of structural steel sheet/strip steels including cold formed members which are equal to or less than 3/16 inch (.188 in./4.8mm) in nominal thickness. Three weld types unique to sheet steel, arc spot, arc seam, and arc plug welds are included in this code.

❖ AWS D1.4: Structural Welding Code for Reinforcing Steel

This is the Structural Welding Code-Reinforcing Steel. This code shall apply to the welding of reinforcing steel to reinforcing steel and of reinforcing steel to carbon or low-alloy structural steel. This code shall be used in conjunction with the prescribed general building code specifications and is applicable to all welding of reinforcing steel using the processes listed in Section 1.4, and performed as a part of reinforced concrete construction. When reinforcing

steel is welded to structural steel, the provisions of AWS D1.1 shall apply to the structural steel component.

❖ **AWS D1.5: Bridge Welding Code**

This is the Bridge Welding Code. This code covers welding fabrication requirements applicable to welded highway bridges. It is to be used in conjunction with the AASHTO Standard Specification for Highway Bridges or the AASHTO LRFD Bridge Design Specifications. This code is not intended to be used for the following: steels with a minimum specified yield strength greater than 690 MPa (100ksi), pressure vessels or pressure piping, base metals other than carbon or low alloy steels, or structures composed of structural tubing.

American Society of Mechanical Engineers (ASME)

ASME is a not-for-profit membership organization that enables collaboration, knowledge sharing, career enrichment, and skills development across all engineering disciplines, toward a goal of helping the global engineering community develop solutions to benefit lives and livelihoods.

The organization has approximately 600 consensus standards developed by over 100 committees. In general, standards address:

- performance test codes
- standardization
- safety
- nuclear technology
- pressure technology

❖ **ASME Section I: Requirements for Power boilers**

Part PW lists the Requirements for Boilers Fabricated By Welding. The rules in Part PW are applicable to boilers and component parts thereof, including piping constructed under the provisions of this Section that are fabricated by welding and shall be used in conjunction with the general requirements of Part PG as well as with the specific requirements in the applicable Parts of this Section that pertain to the type of boiler under consideration.

❖ **ASME Section II Material Specifications-4 Subparts(A,B,C,D):**

Subpart A-Ferrous Material Specifications.

Subpart B-Non-Ferrous Material Specifications-Materials.

Subpart C-Specifications for Welding Rods, Electrodes, and Filler Metals.

Subpart D- Properties-divided into three subparts-

1. Stress Tables.
2. Physical Properties Tables.
3. Charts and Tables for Determining Shell Thickness of Components Under External Pressure.

❖ **ASME Section III: Nuclear**

There are Three Subdivisions-

Division 1-Rules For Construction of Nuclear Facility Components.

Subsection NB lists Class 1 Components.

Subsection NC lists Class 2 Components.

Subsection ND lists Class 3 Components.

Subsection NE lists Class MC Components.

Subsection NF covers Supports.

Subsection NG deals with Core Support Structures.

Subsection NH covers Class 1 Components in Elevated Temperature Service.

Division 2: Code For Concrete Reactor Vessels and Containment.
Division 3" Containment Systems for Storage and Transport Packaging of Spent Nuclear Fuel and High Level Radioactive Material and Waste. ·

❖ **ASME Section IV: Rules For Construction of Heating Boilers.**

The rules to Part HG apply to steam heating boilers, hot water heating boilers, hot water supply boilers, and appurtenances thereto. They shall be used in conjunction with the specific requirements of Parts HF and HC whichever is applicable. The forward provides the basis for these rules. Part HG is not intended to apply to potable water heaters except as provided for in Part HLW.

❖ **ASME Section V: Non-Destructive Examination**

Unless otherwise specified by the referencing Code Section, or other referencing documents, this Section of the Code contains requirements and methods for nondestructive examination which are Code requirements to the extent they are specifically referenced and required by other Code Sections. These nondestructive examination methods are intended to detect surface and internal discontinuities in materials, welds, and fabricated parts and components. They include radiographic examination, ultrasonic examination, liquid penetrant examination, magnetic particle examination, eddy current examination, visual examination, leak testing, and acoustic emission examination.

American Society for Non-Destructive Testing (ASNT Codes)

The American Society for Nondestructive Testing, Inc. (ASNT) is the world's largest technical society for nondestructive testing (NDT) professionals.

- SNT-TC-1A-2011: Recommended Practice No.
- SNT-TC-1A: Personnel Qualification and Certification in Non-Destructive Testing

This program is a guideline to assist employers to establish their own in-house certification program. It is a set of recommendations for the qualification and certification of NDT personnel. It also provides recommended educational, experience and training for the NDT methods.

ANSI/ASNT-CP 189-2011: ASNT Standard for Qualification and Certification of Non-Destructive Testing Personnel

This document is a Standard that establishes minimum requirements for the qualification and certification of non-destructive testing and predictive maintenance personnel. It also details the minimum training, education, and experience requirements for NDT personnel and provides criteria for documenting qualifications and certification.



ACTIVITIES

A. **Directions:** Identify the codes and standards described below. Write your answer in a separate sheet of paper.

1. It covers the maintenance inspection, repair, alteration, relocation, and reconstruction of tanks.
2. This code shall apply to the welding of reinforcing steel to reinforcing steel and of reinforcing steel to carbon or low-alloy structural steel.
3. This code covers the arc welding of structural steel sheet/strip steels including cold formed members which are equal to or less than 3/16 inch (.188 in./4.8mm) in nominal thickness.
4. This Section of the Code contains requirements and methods for nondestructive examination which are Code requirements to the extent they are specifically referenced and required by other Code Sections.
5. The code was written for groups that have access to or maintain an authorized inspection agency, a repair group, and technically qualified piping engineers, inspectors, and examiners.



REMEMBER

- Many aspects of the design and fabrication of welded components are governed by documents known as codes and standards.
- Welding codes and standards are often used in welding to assist with the development of their process control system. If we consider the major elements of process control, as specified by such standards for quality systems, we will recognize those same elements as being addressed within the welding code or standard.



CHECK YOUR UNDERSTANDING

Directions: Write a reflection about the importance of welding codes and standards. Use separate sheet of paper for your answer.



POST TEST

Directions: Read the statements carefully and choose the letter of the correct answer. Write your answer in a separate sheet of paper.

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REFERENCES:

Public Technical Vocational Schools, COMPETENCY-BASED LEARNING MATERIAL, Third Year, Shielded Metal Arc Welding [Department of Education 2008]

Welding Technology, 2nd Edition, Gower A. Kennedy

Welding Guide Fabrication Shop, Ismael V. Palabrica

Metal Works 1, SEDP Series, Industrial Technology

Basic Manual Metal Arc Welding, National Training Center for Technical Education and Staff Development

Welding Principles and Applications, Larry Jeffus and Harold V. Johnson

Key to Correction:

10. A
9. D
8. C
7. D
6. A
5. A
4. D
3. C
2. A
1. B
Pretest

10. A
9. D
8. C
7. A
6. B
5. D
4. D
3. A
2. D
1. C
Posttest