



# Welding

## Study Guide

### Assessments:

**4301 Shielded Metal Arc Welder**

**4302 Gas Metal Arc Welder**

**4303 Flux Cored Arc Welder**

**4304 Gas Tungsten Arc Welder**

**4305 Cutting Process Operator**

Aligned to AWS Level I –  
Entry Welding Completion  
Requirements & NCCER  
National Standards

Endorsed By:



## Overview

This study guide is designed to help students prepare for the Welding assessments. It not only includes information about the assessments, but also the skill standards upon which the assessments are based, resources that can be used to prepare for the assessments, and test taking strategies.

Each of the four sections in this guide provides useful information for students preparing for any of the Welding assessments.

- CareerTech and Competency-Based Education: A Winning Combination
- Welding assessments
  - ▶ Assessment Information
  - ▶ Standards and Test Content
  - ▶ Sample Questions
  - ▶ Textbook/Curriculum Crosswalk
  - ▶ Abbreviations, Symbols, and Acronyms
- Strategies for Test Taking Success
- Notes

These assessments were developed and aligned with the American Welding Society (AWS) completion requirements for Level I — Entry Welder SENSE certification. The AWS' School of Excelling through National Skill Standards Education (SENSE) is a comprehensive set of minimum Standards and Guidelines for Welding Education programs. Schools can incorporate SENSE into their own curriculum to attain Perkins funding and insure an education that is consistent with other SENSE schools across the nation. The welding assessments offered through the CareerTech Testing Center of the Oklahoma Department of Career and Technology Education can be used to meet the completion requirements for SENSE certification.

The Welding assessments measure a student's ability to apply knowledge and skills as an Entry Level Welder. The CareerTech Testing Center has modularized our assessments to provide a complete assessment for each required module to receive partial or full SENSE level certification for an Entry Welder in one of the five areas of emphasis — Shield Metal Arc Welding, Gas Metal Arc Welding, Flux-Cored Arc Welding, Gas Tungsten Arc Welding, or Cutting Process Operator. These assessments are designed to prepare a student for the industry-recognized credentialing assessment.

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## CareerTech and Competency-Based Education: A Winning Combination

Competency-based education uses learning outcomes that emphasize both the application and creation of knowledge and the mastery of skills critical for success. In a competency-based education system, students advance upon mastery of competencies, which are measurable, transferable outcomes that empower students.

Career and technology education uses industry professionals and certification standards to identify the knowledge and skills needed to master an occupation. This input provides the foundation for development of curriculum, assessments and other instructional materials needed to prepare students for wealth-generating occupations and produce comprehensively trained, highly skilled employees demanded by the work force.

### Tools for Success

CareerTech education relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

**Skills standards** provide the foundation for competency-based instruction and outline the knowledge and skills that must be mastered in order to perform related jobs within an industry. Skills standards are aligned with national skills standards and/or industry certification requirements; therefore, a student trained to the skills standards is equally employable in local, state and national job markets.

**Curriculum materials and textbooks** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources include supplemental activities that enhance learning by providing opportunities to apply knowledge and demonstrate skills.

**Certification Assessments** test the student over material outlined in the skills standards and taught using the curriculum materials and textbooks. When used with classroom performance evaluations, certification assessments provide a means of measuring occupational readiness.

Each of these components satisfies a unique purpose in competency-based education and reinforces the knowledge and skills students need to gain employment and succeed on the job.

### Measuring Success

Evaluation is an important component of competency-based education. Pre-training assessments measure the student's existing knowledge prior to receiving instruction and ensure the student's training builds upon this knowledge base. Formative assessments administered throughout the training process provide a means of continuously monitoring the student's progress towards mastery.

Certification assessments provide a means of evaluating the student's mastery of knowledge and skills. Coaching reports communicate assessment scores to students and provide a breakdown of assessment results by standard area. The coaching report also shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

# Welding Assessment Information

## What are the Welding assessments?

The Welding assessments are end-of-program assessments for students in entry level welding programs. The assessments provide an indication of student mastery of knowledge and skills necessary for success in welding careers.

## How were the assessments developed?

The assessments were developed by the CareerTech Testing Center to align with the AWS Level I— Entry Welding completion requirements outlined in AWS QCI0 and EG 2.0. A committee of industry representatives and educators validated the modules covered on the five assessments. Each assessment’s content was developed and reviewed by a committee of subject matter experts, including a representative from the AWS.

The committee assigned frequency and criticality ratings to each skill, which determines the significance of each task for test development:

**Frequency:** represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

1 = less than once a week      2 = at least once a week      3 = once or more a day

**Criticality:** denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

1 = slight                                      2 = moderate                                      3 = extreme

## What do the assessments cover?

Specifically, each test incorporates various modules required for partial or full completion in the area of emphasis. The areas of emphasis are as follows for each assessment:

### Shielded Metal Arc Welder (82 questions)

Safety & Health of Welders	24%	Welding Inspection & Testing	3%
Drawing & Welding Symbol Interpretation	18%	Electrical Fundamentals	5%
Shield Metal Arc Welding Principles	41%	Mathematical Operations	9%

### Gas Metal Arc Welder (79 questions)

Safety & Health of Welders	20%	Welding Inspection & Testing	4%
Drawing & Welding Symbol Interpretation	18%	Electrical Fundamentals	5%
Gas Metal Arc Welding Principles	44%	Mathematical Operations	9%

### Flux Cored Arc Welder (77 questions)

Safety & Health of Welders	21%	Welding Inspection & Testing	4%
Drawing & Welding Symbol Interpretation	18%	Electrical Fundamentals	5%
Flux Cored Arc Welding Principles	43%	Mathematical Operations	9%

### **Gas Tungsten Arc Welder** (74 questions)

Safety & Health of Welders	22%	Welding Inspection & Testing	4%
Drawing & Welding Symbol Interpretation	19%	Electrical Fundamentals	5%
Gas Tungsten Arc Welding Principles	41%	Mathematical Operations	9%

### **Cutting Process Operator** (84 questions)

Safety & Health of Welders	19%	Welding Inspection & Testing	3%
Drawing & Welding Symbol Interpretation	17%	Electrical Fundamentals	5%
Thermal Cutting Processes (Units 1-4)	47%	Mathematical Operations	9%

## **What are the benefits of using these assessments?**

Students receive a certificate for each assessment that he/she passes. This certificate may be included in his/her portfolio and used to communicate the student's mastery of the subject matter to potential employers.

If a student is enrolled at a SENSE participating organization and passes all performance measures, these assessments can be used to meet the written test requirements for partial or full completion for AWS SENSE. On the written exams, the student must achieve a score of 75% or higher on each of the assessments taken and achieve an overall score of 90% or higher on "Demonstrate Safety Skills" on each assessment taken.

A student who passes all five CTTC assessments may apply for full completion. A student who passes any one of the four welding processes assessments (4301, 4302, 4303, 4304) plus 4305 Cutting Process Operator assessment may apply for partial completion.

## **When should the assessments be taken?**

The CareerTech Testing Center recommends that students take this assessment as soon as possible after receiving all standards-related instruction, rather than waiting until the end of the school year.

## **Are the assessments timed?**

No. Although students may take as long as they need, most finish the assessment within one hour.

## **What resources can students use on these assessments?**

Students are allowed to use calculators and scratch paper on CTTC assessments; however, these items must be provided by the testing proctor and returned to the proctor before the student's exam is submitted for scoring. Calculator apps on cell phones and other devices may not be used on these assessments.

Students taking these assessments may access the following chart during testing:

*Conversions for Common Welding Terms*

**<http://www.okcareertech.org/educators/assessments-and-testing/testing/resources/welding-terms-chart.pdf>**

## What accommodations can be made for students with Individualized Education Plans (IEPs)?

Accommodations are allowed for students with an Individualized Education Plan. Examples of allowable accommodations include:

- Extended time — This assessment is not timed, therefore students may take as much time as needed to finish. The assessment must be completed in one testing session.
- Readers — A reader may be used to read the assessment to a student who has been identified as needing this accommodation.
- Enlarged text — Students needing this accommodation can activate this feature by clicking the **AA** icon in the upper right corner of the screen.

## What can students expect on Test Day?

All CTTC assessments are web-based and delivered exclusively by a proctor in the school's assessment center. The proctor **cannot** be an instructor or anyone who was involved with the student during instruction.

Assessments are delivered in a question-by-question format. When a question is presented, the student can select a response or leave the question unanswered and advance to the next question. Student may also flag questions to revisit before the test is scored. All questions must be answered before the test can be submitted for scoring.

After the assessment is scored, the student will receive a score report that not only shows the student's score on the assessment, but also how the student performed in each standard area.

## Can students retake the test?

Students may retake the test unless their school or state testing policies prohibit retesting. Students who can retest must wait at least three days between test attempts.



# Standards and Test Content

## Safety and Health of Welders

1. Understand and explain the purpose of safety policies **(3/3)**
2. Explain the proper steps in reporting an accident or emergency **(3/3)**
3. Describe and discuss established first aid procedures **(3/3)**
4. Describe and discuss the role of the Occupational Safety and Health Act (OSHA) and the EPA (Environmental Protection Agency) **(3/3)**
5. Demonstrate knowledge of OSHA requirements **(3/3)**
  - Lock Out/Tag out procedures
  - Personal protective equipment
  - Precautionary labeling
  - Working in confined spaces
  - Hot work permits
  - HAZCOM
  - SDS
  - Bloodborne Pathogens
6. Explain fall protection, ladder, stair, and scaffold procedures and requirements **(3/3)**
7. Explain the hazards associated with specific welding process, material, equipment and tools **(3/3)**
8. Demonstrate safety techniques for storing and handling cylinders **(3/3)**
9. Describe workplace fire hazards and how to properly extinguish fires **(3/3)**
10. Discuss electrical hazards and how to avoid electric shock **(3/3)**
11. Demonstrate proper use and inspection of equipment used for ventilation and how to avoid welding fumes **(3/3)**
12. Demonstrate safe material handling techniques **(3/3)**
  - Lifting
  - Transporting
  - Storing
13. Practice tool safety **(3/3)**
14. Practice good housekeeping and work area operation **(3/3)**
15. Perform safety inspection of equipment and accessories **(3/3)**
  - Protective clothing and equipment
  - Hand and power tools
  - Work area
  - Communicate hazard warnings
  - Welding equipment and accessories



## Drawing and Welding Symbol Interpretation

1. Interpret basic elements of a drawing or sketch **(3/3)**
  - Terms
  - Components
  - Revisions
  - Symbols
  - Structural members
  - Inspection/test requirements
  - Sequence of assembly
  - Dimensions and tolerances
  - Scale
  - View interpretation
  - List of materials
2. Interpret welding symbol information **(1/3)**
  - Type of weld required
  - Filler metal
  - Special details
  - Non-destructive testing requirements
3. Interpret written welding procedures **(3/3)**
  - Procedure ID number cross-referencing to drawing
  - Appropriate welding process/base materials/filler materials
  - Appropriate machine settings
4. Fabricate parts from a drawing or sketch **(3/3)**
  - Prepare, assemble, and tack weld parts according to drawing or sketch specifications

## Shielded Metal Arc Welding (SMAW) Principles and Practices

1. Set up for shielded metal arc welding on carbon steel plate and pipe **(3/3)**
  - E7024, E6010, or E6011 and E7018 electrodes
  - Base/filler metal selection/identification/preparation
  - Review appropriate weld procedures
  - Filler metal selection
  - Proper hand tool selection
  - Adjust amperage and polarity
  - Base metal preparation
  - Parts fit up and preheated as necessary
2. Operate shielded metal arc welding equipment **(3/3)**
  - Flat single pass surfacing welds
  - Flat multiple pass, multi-directional, surfacing welds
3. Make fillet welds in all positions, on carbon steel plate, and on pipe in the 2F position **(3/3)**
  - Multi-pass start/stop points staggered
  - Different techniques for different electrodes
4. Make groove welds in all positions, on carbon steel plate with and without backing **(3/3)**
  - Multi-pass start/stop points staggered
  - Different techniques for different electrodes



## Gas Metal Arc Welding (GMAW) Principles and Practices

1. Set up for gas metal arc welding operations on carbon steel plate **(3/3)**
  - Filler metal selection
  - Proper hand tool selection
  - Adjust voltage and polarity
  - Set wire speed (amperage)
  - Proper gas flow rate
  - Parts fit up and preheated as necessary
  - Review appropriate weld procedures
  - Base metal preparation
2. Operate gas metal arc welding **(3/3)**
3. Short circuit transfer **(3/3)**
  - Make fillet welds, all positions, on carbon steel plate and pipe in 2F position-flat, multiple pass, surfacing welds
  - Make groove welds, all positions, on carbon steel plate with backing and pipe in 1G
4. Spray transfer **(3/3)**
  - Make 1F and 2F welds on carbon steel plate
  - Make 1G welds on carbon steel plate



## Flux Cored Arc Welding (FCAW, FCAW-F/GM) Principles and Practices

1. Set up for flux cored arc welding operations on carbon steel plate and pipe **(3/3)**
  - Review appropriate weld procedures
  - Base metal preparation
  - Filler metal selection
  - Proper hand tool selection
  - Adjust voltage and polarity
  - Set wire speed (amperage)
  - Proper gas flow rate
  - Parts fit up and preheated as necessary
2. Operate flux cored arc welding equipment **(3/3)**
  - Flat single pass surfacing welds
  - Flat multiple pass surfacing welds
3. Make fillet welds in all positions on carbon steel plate **(3/3)**
4. Make groove welds in all positions on carbon steel plate **(3/3)**

## Gas Tungsten Arc Welding (GTAW) Principles and Practices

1. Set up for gas tungsten arc welding operations on carbon steel plate, aluminum, and stainless steel plate **(3/3)**
  - Review appropriate weld problems
  - Filler metal selection
  - Adjust amperage
  - Proper gas flow rate
  - Parts fit up and preheated as necessary
  - Base metal preparation
  - Polarity
  - Gas selection
  - Electrode selection
2. Operate gas tungsten arc welding equipment **(3/3)**
  - Make fillet and groove welds on carbon steel plate, aluminum and stainless steel plate
3. Make fillet welds, 2F and 3F positions, on carbon steel plate **(3/3)**
4. Make groove welds, 3G position without backing, on carbon steel plate **(3/3)**
5. Make 1F-2F welds on aluminum plate **(3/3)**
6. Make 1G with backing welds on aluminum plate **(3/3)**
7. Make 1F-2F-3F welds on stainless steel plate **(3/3)**
8. Make 1G-2G-3G welds on stainless steel plate **(3/3)**



## Thermal Cutting Processes (Units 1-4) — Manual Oxy-Fuel Gas Cutting (OFC) Principles and Practices

1. Set up for manual oxy-fuel gas cutting operations on carbon steel plate **(3/3)**
  - Regulator set for appropriate tip/fuel gas/material
  - Tip selection (size and type)
2. Operate manual oxy-fuel cutting equipment **(3/3)**
  - Control gas flow and flame size/type
  - Start up procedure
  - Shut down procedure
  - Correct torch angle
  - Travel speed
3. Perform straight cutting operations on carbon steel plate and pipe **(3/3)**
4. Perform shape cutting operations on carbon steel plate and pipe **(3/3)**
5. Perform bevel cutting operations on carbon steel plate and pipe **(3/3)**

## **Thermal Cutting Processes (Units 1-4) — Mechanized Oxy-Fuel Gas Cutting (OFC) Principles and Practices**

1. Set up for oxy-fuel gas cutting (track burner) operations on carbon steel plate machine **(3/3)**
  - Regulator set on appropriate tip/fuel gas
  - Tip selection (size and type)
  - Corner measurement and alignment of track mechanism
  - Travel speed
  - Straight cutting operations on carbon steel plate
  - Bevel cutting operation on carbon steel plate
2. Operate machine oxy-fuel gas cutting (track burner) equipment **(3/3)**
  - Control gas flow and flame size
  - Start up procedure
  - Shut down procedure
  - Travel speed

## **Thermal Cutting Processes (Units 1-4) — Manual Plasma Arc Cutting (PAC) Principles and Practices**

1. Set up for manual plasma arc cutting operations on carbon steel plate, aluminum, and stainless steel plate **(3/3)**
  - Regulators set for appropriate plasma gas
  - Tip selection
2. Operate manual plasma arc cutting equipment **(3/3)**
  - Protect surroundings from spray
3. Perform shape cutting operations on carbon steel plate, aluminum, and stainless steel plate **(3/3)**

## **Thermal Cutting Processes (Units 1-4) — Air Carbon Arc Cutting (CAC-A) Principles and Practices**

1. Set up for manual air carbon arc gouging and cutting operations on carbon steel plate **(3/3)**
  - Adequate power source selection
  - Carbon electrode diameter selection
  - Air flow direction
  - Machine variables
  - Communicate hazard warnings
2. Operate manual air carbon arc cutting equipment **(3/3)**
  - Air before arc
  - Process variables
  - Travel speed determines depth
3. Perform metal removal operations on carbon steel plate **(3/3)**

## Welding Inspection and Testing Principles

1. Examine cut surfaces and edges of prepared base metal parts **(3/3)**
  - Appearance
  - Uniformity
  - Proper fit-up
  - Base metal preparation
  - Cleanliness of weld area
2. Examine tack, intermediate layers, and completed welds **(3/3)**
  - Visual check for weld discontinuity and defects to an acceptable criteria
  - Destructive or non-destructive examination
  - Check for proper weld size
  - Understand types of destructive and nondestructive exams



## Electrical Fundamentals

1. Demonstrate the fundamental use of polarity with respect to equipment set up for the processes used **(3/3)**
2. Perform routine electrical equipment inspections and operation system troubleshooting **(3/3)**
3. Demonstrate compliance with electrical safety postings and personal shock prevention practices **(3/3)**
4. Make minor external repairs to equipment and accessories **(1/3)**
  - Manufacturer's recommendations
  - Company's and/or institution's repair policies
  - Equipment troubleshooting
  - Regulators

## Perform Mathematical Operations

1. Demonstrate conversion between the US customary and SI metric systems **(3/3)**
2. Add, subtract, multiply, divide, and convert between whole numbers, fractions, mixed numbers, and decimals **(3/3)**
3. Demonstrate the proper use of and interpretation of measuring devices to determine size, length, angle, and distance **(3/3)**
4. Use a calculator and demonstrate rounding of basic arithmetic operations **(3/3)**
5. Prepare parts using the principles of geometry, functions of angles and parts of a circle **(3/3)**



## Sample Questions

- \_\_\_\_\_ 1. The standard for safety in welding is \_\_\_\_\_.
- ANSI Z49.1-1999, Safety in Welding, Cutting, and Allied Processes
  - API 1104, Standard for Welding Pipelines and Related Facilities
  - ASTM, American Standards of Testing Materials
  - Section III of ASME Boiler and Pressure Vessel Code
- \_\_\_\_\_ 2. When should accidents be reported?
- at the earliest convenience
  - before the end of the shift
  - immediately
  - the next day
- \_\_\_\_\_ 3. What part of the welding symbol is used to convey specifications or processes?
- arrow
  - reference line
  - tail
  - starting point
- \_\_\_\_\_ 4. As arc length increases, current \_\_\_\_\_.
- decreases
  - increases
  - increases, then decreases
  - remains constant
- \_\_\_\_\_ 5. A trigger-operated, on-off device allowing the filler metal, shielding gas, and power to pass through is called the \_\_\_\_\_.
- flow meter
  - gun
  - power supply
  - wire feeder
- \_\_\_\_\_ 6. A Hi-Lo gauge is primarily used to check \_\_\_\_\_.
- 45° joints
  - 90° joints
  - I-beam joint alignment
  - pipe joint alignment

- \_\_\_\_\_ 7. In FCAW, an electrode for welding in the flat position should bear what designation?
- a. 0
  - b. I
  - c. F
  - d. T
- \_\_\_\_\_ 8. What criterion is considered when selecting any oxy-fuel cutting tip size?
- a. age of the tip
  - b. fuel type being used
  - c. job completion time
  - d. thickness of material
- \_\_\_\_\_ 9. What is the best sequence to light an oxy-acetylene torch?
- a. purge, turn on fuel, ignite, turn on oxygen
  - b. purge, turn on oxygen, turn on fuel, ignite
  - c. turn on fuel, turn on oxygen, purge, ignite
  - d. turn on fuel, purge, turn on oxygen, ignite
- \_\_\_\_\_ 10. What type of porosity exhibits a concentrated grouping of pores?
- a. clustered
  - b. linear
  - c. symmetrical
  - d. uniformed



## Sample Questions — Key

1. The standard for safety in welding is \_\_\_\_\_.
- a. ANSI Z49.1-1999, Safety in Welding, Cutting and Allied Processes Correct by definition
  - b. API 1104, Standard for Welding Pipelines and Related Facilities Incorrect by definition
  - c. ASTM, American Standards of Testing Materials Incorrect by definition
  - d. Section III of ASME Boiler and Pressure Vessel Code Incorrect by definition
2. When should accidents be reported?
- a. at the earliest convenience Wrong, but plausible
  - b. before the end of the shift Wrong, but plausible
  - c. immediately Correct
  - d. the next day Wrong, but plausible
3. What part of the welding symbol is used to convey specifications or processes?
- a. arrow Incorrect by definition
  - b. reference line Incorrect by definition
  - c. tail Correct
  - d. starting point Incorrect by definition
4. As arc length increases, current \_\_\_\_\_.
- a. decreases Correct
  - b. increases Incorrect by definition
  - c. increases, then decreases Incorrect by definition
  - d. remains constant Incorrect by definition
5. A trigger-operated, on-off device allowing the filler metal, shielding gas, and power to pass through is called the \_\_\_\_\_.
- a. flow meter Incorrect by definition
  - b. gun Correct by definition
  - c. power supply Incorrect by definition
  - d. wire feeder Incorrect by definition
6. A Hi-Lo gauge is primarily used to check \_\_\_\_\_.
- a. 45° joints Wrong, but plausible
  - b. 90° joints Wrong, but plausible
  - c. I-beam joint alignment Wrong, but plausible
  - d. pipe joint alignment Correct

7. In FCAW, an electrode for welding in the flat position should bear what designation?

- a. 0                    Correct by definition
- b. I                    Incorrect by definition
- c. F                    Incorrect by definition
- d. T                    Incorrect by definition

8. What criterion is considered when selecting any oxy-fuel cutting tip size?

- a. age of the tip                    Wrong, but plausible
- b. fuel type being used            Wrong, but plausible
- c. job completion time            Wrong, but plausible
- d. thickness of material            Correct

9. What is the best sequence to light an oxy-acetylene torch?

- a. purge, turn on fuel, ignite, turn on oxygen                    Correct
- b. purge, turn on oxygen, turn on fuel, ignite                    Wrong, but plausible
- c. turn on fuel, turn on oxygen, purge, ignite                    Wrong, but plausible
- d. turn on fuel, purge, turn on oxygen, ignite                    Wrong, but plausible

10. What type of porosity exhibits a concentrated grouping of pores?

- a. clustered                    Correct by definition
- b. linear                    Incorrect by definition
- c. symmetrical                Incorrect by definition
- d. uniformed                Incorrect by definition



## Curricula Crosswalk

### Crosswalk to AWS Level I — Entry Level Welder requirements, NCCER Modules, and Multistate Academic and Vocational Curriculum Consortium (MAVCC) Welding Series

The following crosswalk is intended for guidance purposes only. It does not represent all curricula or resource materials that may be used for welding programs. It is intended as a reference for curriculum planning and mapping standards to available curricula.

#### Curriculum/Resource Titles:

- 1) MAVCC — Fundamentals of Welding
- 2) MAVCC — Shielded Metal Arc Welding & Carbon Arc Cutting-Air
- 3) MAVCC — Gas Tungsten Arc Welding & Plasma Arc Cutting
- 4) MAVCC — Gas Metal Arc Welding & Flux-Cored Arc Welding
- 5) MAVCC — Oxyacetylene Welding and Oxyfuel Cutting
- 6) MAVCC — Shielded Metal Arc Pipe Welding
- 7) AWS QCI0 and EG 2.0
- 8) NCCER – Welding Level 1
- 9) NCCER – Welding Level 2
- 10) NCCER – Welding Level 3
- 11) NCCER – Welding Advanced Topics

For more information about MAVCC curricula, please go to [www.okcimc.com](http://www.okcimc.com).

Module Name — Objective	Unit/Module
<b>Safety and Health of Welders</b>	1) Unit 1-4 4) Unit 1 7) Module 2 8) Module 29101
1. Understand and explain the purpose of safety policies	1) Unit 3.2 7) Module 2 8) Module 29101
2. Explain the proper steps in reporting an accident or emergency	1) Unit 3.18 7) Module 2 8) Module 29101
3. Describe and discuss established first aid procedures	1) Unit 3 7) Module 2 8) Module 29101
4. Describe and discuss the role of OSHA & the EPA	1) Unit 2.1 7) Module 2 8) Module 29101
5. Demonstrate knowledge of OSHA requirements	1) Unit 2.1 7) Module 2 8) Module 29101

<b>Module Name — Objective</b>	<b>Unit/Module</b>
6. Explain fall protection, ladder, stair, and scaffold procedures and requirements	1) Unit 2.18, 2.20, 2.30 7) Module 2 8) Module 29101
7. Explain the hazards associated with specific welding process, material, equipment and tools	1) Unit 2.3 7) Module 2 8) Module 29101
8. Demonstrate safety techniques for storing and handling cylinders	1) Unit 3.14 7) Module 2 8) Module 29101
9. Describe workplace fire hazards and how to properly extinguish fires	1) Unit 2.10-14 7) Module 2 8) Module 29101
10. Discuss electrical hazards and how to avoid electric shock	1) Unit 2.3f, 3.19 4) Unit 1.7 7) Module 2 8) Module 29101
11. Demonstrate proper use and inspection of equipment used for ventilation and how to avoid welding fumes	7) Module 2 8) Module 29101
12. Demonstrate safe material handling techniques	7) Module 2 8) Module 29101
13. Practice tool safety	1) Unit 2.3d, 3.9, 4.20-22 7) Module 2 8) Module 29101
14. Practice good housekeeping and work area operation	4) All Job Sheets 7) Module 2 8) Module 29101
15. Perform safety inspection of equipment and accessories	1) Unit 2 7) Module 2 8) Module 29101
<b>Drawing and Welding Symbol Interpretation</b>	1) Unit 7, Unit 8 7) Module 3 9) Module 29201, 29202, 29203
1. Interpret basic elements of a drawing or sketch	1) Unit 7.4 7) Module 3 9) Module 29202
2. Interpret welding symbol information	1) Unit 7, Unit 8.2, 8.10-8.14 7) Module 3 9) Module 29201, 29203
3. Interpret written welding procedures	7) Module 3 9) Module 29201
4. Fabricate parts from a drawing or sketch	7) Module 3 9) Module 29202

Module Name — Objective	Unit/Module
<b>Shielded Metal Arc Welding (SMAW) Principles and Practices</b>	3) Unit 1, Unit 2 7) Module 4 8) Module 29105, 29107, 29108, 29109, 29110, 29111, 29112 9) Module 29204 10) Module 29301, 29306
1. Set up for shielded metal arc welding on carbon steel plate and pipe	3) Unit 1 & 2 7) Module 4 8) Module 29105, 29107, 29108, 29110 9) Module 29204
2. Operate shielded metal arc welding equipment	3) Unit 1 & 2 7) Module 4 8) Module 29105
3. Make fillet welds in all positions, on carbon steel plate, and on pipe in the 2F position	3) Unit 1 & 2 7) Module 4 8) Module 29109
4. Make groove welds in all positions, on carbon steel plate with and without backing	3) Unit 1 & 2 7) Module 4 8) Module 29111, 29112, 10) Module 29301, 29306
<b>Gas Metal Arc Welding (GMAW) Principles and Practices</b>	4) Unit 2 7) Module 5 8) Module 29105, 29110 9) Module 29204, 29205, 29206, 10) Module 29302 11) Module 29401, 29404
1. Set up for gas metal arc welding operations on carbon steel plate	4) Unit 2 7) Module 5 8) Module 29105, 29110 9) Module 29204, 29205, 29206
2. Operate gas metal arc welding	4) Unit 2 7) Module 5 9) Module 29205
3. Short circuit transfer	4) Unit 2 7) Module 5 9) Module 29206 10) Module 29302 11) Module 29404
4. Spray transfer	4) Unit 2 7) Module 5 9) Module 29206 10) Module 29302 11) Module 29401

Module Name — Objective	Unit/Module
<b>Flux Cored Arc Welding (FCAW, FCAW-F/GM) Principles and Practices</b>	4) Unit 3 7) Module 6 8) Module 29105, 29110 9) Module 29204, 29205, 29206 10) Module 29303
1. Set up for flux cored arc welding operations on carbon steel plate and pipe	4) Unit 3 7) Module 6 8) Module 29105, 29110 9) Module 29204, 29205, 29206
2. Operate flux cored arc welding equipment	4) Unit 3 7) Module 6 9) Module 29205, 29206
3. Make fillet welds in all positions on carbon steel plate	4) Unit 3 7) Module 6 9) Module 29206
4. Make groove welds in all positions on carbon steel plate	4) Unit 3 7) Module 6 9) Module 29206 10) Module 29303
<b>Gas Tungsten Arc Welding (GTAW) Principles and Practices</b>	4) Unit 2 7) Module 7 8) Module 29105, 29110 9) Module 29204, 29207, 29208 10) Module 29304, 29305 11) Module 29402, 29403
1. Set up for gas tungsten arc welding operations on carbon steel plate, aluminum, and stainless steel plate	4) Unit 2 7) Module 7 8) Module 29105, 29110 9) Module 29204, 29207
2. Operate gas tungsten arc welding equipment	4) Unit 2 7) Module 7 9) Module 29207
3. Make fillet welds, 2F and 3F positions, on carbon steel plate	4) Unit 2 7) Module 7 9) Module 29208
4. Make groove welds, 3G position without backing, on carbon steel plate	4) Unit 2 7) Module 7 9) Module 29208
5. Make 1F-2F welds on aluminum plate	4) Unit 2 7) Module 7 11) Module 29402, 29403
6. Make 1G with backing welds on aluminum plate	4) Unit 2 7) Module 7 11) Module 29402, 29403

<b>Module Name — Objective</b>	<b>Unit/Module</b>
7. Make 1F-2F-3F welds on stainless steel plate	4) Unit 2 7) Module 7 10) Module 29304, 29305
8. Make 1G-2G-3G welds on stainless steel plate	4) Unit 2 7) Module 7 10) Module 29304, 29305
<b>Thermal Cutting Processes — Manual Oxy-Fuel Gas Cutting (OFC) Principles and Practices</b>	5) Unit 2 7) Module 8 – Unit 1 8) Module 29102, 29105, 29110 9) Module 29204
1. Set up for manual oxy-fuel gas cutting operations on carbon steel plate	5) Unit 2 7) Module 8 – Unit 1 8) Module 29102, 29105, 29110
2. Operate manual oxy-fuel cutting equipment	5) Unit 2 7) Module 8 – Unit 1 8) Module 29102 9) Module 29204
3. Perform straight cutting operations on carbon steel plate and pipe	5) Unit 2 7) Module 8 – Unit 1 8) Module 29102
4. Perform shape cutting operations on carbon steel plate and pipe	5) Unit 2 7) Module 8 – Unit 1 8) Module 29102
5. Perform bevel cutting operations on carbon steel plate and pipe	5) Unit 2 7) Module 8 – Unit 1 8) Module 29102
<b>Thermal Cutting Processes — Mechanized Oxy-Fuel Gas Cutting (OFC) Principles and Practices</b>	5) Unit 2 7) Module 8 – Unit 2 8) Module 29102, 29105, 29110 9) Module 29204
1. Set up for oxy-fuel gas cutting (track burner) operations on carbon steel plate machine	5) Unit 2 7) Module 8 – Unit 2 8) Module 29102, 29105, 29110
2. Operate machine oxy-fuel gas cutting (track burner) equipment	5) Unit 2 7) Module 8 – Unit 2 8) Module 29102 9) Module 29204

<b>Module Name — Objective</b>	<b>Unit/Module</b>
<b>Thermal Cutting Processes — Manual Plasma Arc Cutting (PAC) Principles and Practices</b>	4) Unit 3 7) Module 8 – Unit 3 8) Module 29103, 29105, 29110 9) Module 29204
1. Set up for manual plasma arc cutting operations on carbon steel plate, aluminum, and stainless steel plate	4) Unit 3 7) Module 8 – Unit 3 8) Module 29103, 29105, 29110
2. Operate manual plasma arc cutting equipment	4) Unit 3 7) Module 8 – Unit 3 8) Module 29103 9) Module 29204
3. Perform shape cutting operations on carbon steel plate, aluminum, and stainless steel plate	4) Unit 3 7) Module 8 – Unit 3 8) Module 29103 9) Module 29204
<b>Thermal Cutting Processes — Air Carbon Arc Cutting (CAC-A) Principles and Practices</b>	3) Unit 4 7) Module 8 – Unit 4 8) Module 29104, 29105, 29110 9) Module 29204
1. Set up for manual air carbon arc gouging and cutting operations on carbon steel plate	3) Unit 4 7) Module 8 – Unit 4 8) Module 29104, 29105, 29110
2. Operate manual air carbon arc cutting equipment	3) Unit 4 7) Module 8 – Unit 4 8) Module 29104 9) Module 29204
3. Perform metal removal operations on carbon steel plate	3) Unit 4 7) Module 8 – Unit 4 8) Module 29104 9) Module 29204
<b>Welding Inspection and Testing Principles</b>	4) Module Unit 2 7) Module 9 8) Module 29105, 29106
1. Examine cut surfaces and edges of prepared base metal parts	4) Module Unit 2 7) Module 9 8) Module 29105, 29106
2. Examine tack, intermediate layers, and completed welds	4) Module Unit 2 7) Module 9 8) Module 29105, 29106
<b>Electrical Fundamentals</b>	
<b>Perform Mathematical Operations</b>	1) Unit 6 7) Mathematical Operations
1. Demonstrate conversion between the US customer and SI metric systems	1) Unit 6 7) Mathematical Operations

<b>Module Name — Objective</b>	<b>Unit/Module</b>
2. Add, subtract, multiply, divide, and convert between whole numbers, fractions, mixed numbers, and decimals	1) Unit 6 7) Mathematical Operations
3. Demonstrate the proper use of and interpretation of measuring devices to determine size, length, angle, and distance	1) Unit 6 7) Mathematical Operations
4. Use a calculator and demonstrate rounding of basic arithmetic operations	1) Unit 6 7) Mathematical Operations
5. Prepare parts using the principles of geometry, functions of angles and parts of a circle	1) Unit 6 7) Mathematical Operations

## Abbreviations, Symbols and Acronyms

The following is a list of abbreviations, symbols, and acronyms used in the Welding study guide and on the Welding assessments.

°	Degree	ft <sup>3</sup> /hr	Cubic Feet per Hour
°F	Degree Fahrenheit	ft <sup>3</sup> /min	Cubic Feet per Minute
\$	Dollars	G	Gauge Designation (IG)
'	Foot/feet	GMAW	Gas Metal Arc Welding (Welder)
"	Inch/inches	GTAW	Gas Metal Tungsten Welding (Welder)
Ω	Ohms	HAZCOM	Hazard Communication
%	Percent	kg	Kilograms
A	Amperage/Amps/Amperes	in/min	Inches per Minute
AC	Alternating Current	I.D.	Inside Diameter
ACHF	Alternating Current High Frequency	lb	Pound/Pounds
AMSE	American Society of Mechanical Engineers	MIG	Metal Inert Gas
ANSI	American National Standards Institute	mm	Millimeter
API	American Petroleum Institute	mm/s	Millimeter per second
AWS	American Welding Society	NCCER	National Center for Construction Education and Research
CAC	Carbon Arc Cutting	OCV	Open Circuit Voltage
CAC-A	Carbon Arc Cutting – Air	O.D.	Outside Diameter
CO <sub>2</sub>	Carbon Dioxide	OFC	Oxy-fuel Gas Cutting
CPO	Cutting Process Operator	OSHA	Occupation Safety and Health Act
DC	Direct Current	PAC	Plasma Arc Cutting
DCEN	Direct Current Electrode Negative	psi	pounds per square inch
DCEP	Direct Current Electrode Positive	SDS	Safety Data Sheet
DCSP	Direct Current Straight Polarity	SMAW	Shielded Metal Arc Welding (Welder)
E	Electrode Designation (i.e. E6010)	V	Voltage/Volts
EPA	Environmental Protection Agency	W	Watts
F	Filler Designation (i.e. 3F)	WPS	Welding Procedure Specification
FCAW	Flux Cored Arc Welding (Welder)		



## Test Taking Strategies

This section of the study guide contains valuable information for testing success and provides a common-sense approach for preparing for and performing well on any test.

### General Testing Advice

1. Get a good night's rest the night before the test — eight hours of sleep is recommended.
2. Avoid junk food and “eat right” several days before the test.
3. Do not drink a lot or eat a large meal prior to testing.
4. Be confident in your knowledge and skills!
5. Relax and try to ignore distractions during the test.
6. Focus on the task at hand — taking the test and doing your best!
7. Listen carefully to the instructions provided by the exam proctor. If the instructions are not clear, ask for clarification.

### Testing Tips

1. Read the entire question before attempting to answer it.
2. Try to answer the question before reading the choices. Then, read the choices to determine if one matches, or is similar to your answer.
3. Do not change your answer unless you misread the question or are certain that your first answer is incorrect.
4. Answer questions you know first, so you can spend additional time on the more difficult questions.
5. Check to make sure you have answered every question before you submit the assessment for scoring — unanswered questions are marked incorrect.



