

WELDING 1, 2, 3, and 4

DIRECTIONS: Evaluate the student using the applicable rating scales below and check the appropriate box to indicate the degree of competency. The ratings 3, 2, 1, and N are not intended to represent the traditional school grading system of A, B, C, and D. The description associated with each of the ratings focuses on the level of student performance or cognition for each of the competencies listed below.

PERFORMANCE RATING

- 3 - Skilled--can perform task independently with no supervision
 2 - Moderately skilled--can perform task completely with limited supervision
 1 - Limitedly skilled--requires instruction and close supervision
 N - No exposure--has no experience or knowledge of this task

COGNITIVE RATING

- 3 - Knowledgeable--can apply the concept to solve problems
 2 - Moderately knowledgeable--understands the concept
 1 - Limited knowledge--requires additional instruction
 N - No exposure--has not received instruction in this area

NCCER CONTREN® CORE MODULES**MODULE A.****BASIC SAFETY**

- | | | | | |
|----|----|----|----|---|
| 3 | 2 | 1 | N | |
| __ | __ | __ | __ | 1. Identify the responsibilities and personal characteristics of a professional craftsperson. |
| __ | __ | __ | __ | 2. Explain the role that safety plays in the construction crafts. |
| __ | __ | __ | __ | 3. Describe what job-site safety means. |
| __ | __ | __ | __ | 4. Explain the appropriate safety precautions around common job-site hazards. |
| __ | __ | __ | __ | 5. Demonstrate the use and care of appropriate personal protective equipment. |
| __ | __ | __ | __ | 6. Follow safe procedures for lifting heavy objects. |
| __ | __ | __ | __ | 7. Describe safe behavior on and around ladders and scaffolds. |
| __ | __ | __ | __ | 8. Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDs (Material Safety Data Sheets). |
| __ | __ | __ | __ | 9. Describe fire prevention and fire fighting techniques. |
| __ | __ | __ | __ | 10. Define safe work procedures around electrical hazards. |
| __ | __ | __ | __ | 11. Complete 10-hour OSHA course/assessment and receive card. (SDE Requirement) |

MODULE B.**BASIC MATH**

- | | | | | |
|----|----|----|----|---|
| 3 | 2 | 1 | N | |
| __ | __ | __ | __ | 1. Add, subtract, multiply, and divide whole numbers, with and without a calculator. |
| __ | __ | __ | __ | 2. Use a standard ruler and a metric ruler to measure. |
| __ | __ | __ | __ | 3. Add, subtract, multiply, and divide fractions. |
| __ | __ | __ | __ | 4. Add, subtract, multiply, and divide decimals, with and without a calculator. |
| __ | __ | __ | __ | 5. Convert decimals to percents and percents to decimals. |
| __ | __ | __ | __ | 6. Convert fractions to decimals and decimals to fractions. |
| __ | __ | __ | __ | 7. Explain what the metric system is and how it is important in the construction trade. |
| __ | __ | __ | __ | 8. Recognize and use metric units of length, weight, volume, and temperature. |
| __ | __ | __ | __ | 9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them. |

MODULE C:**INTRODUCTION TO HAND TOOLS**

- | | | | | |
|----|----|----|----|--|
| 3 | 2 | 1 | N | |
| __ | __ | __ | __ | 1. Recognize and identify some of the basic hand tools used in the construction trade. |

- | | | | | |
|----|----|----|----|--|
| __ | __ | __ | __ | 2. Use these tools safely. |
| __ | __ | __ | __ | 3. Describe the basic procedures for taking care of these tools. |

MODULE D: INTRODUCTION TO POWER TOOLS

- | | | | | |
|----|----|----|----|--|
| 3 | 2 | 1 | N | |
| __ | __ | __ | __ | 1. Identify commonly used power tools of the construction trade. |
| __ | __ | __ | __ | 2. Use power tools safely. |
| __ | __ | __ | __ | 3. Explain how to maintain power tools properly. |

MODULE E: INTRODUCTION TO BLUEPRINTS

- | | | | | |
|----|----|----|----|---|
| 3 | 2 | 1 | N | |
| __ | __ | __ | __ | 1. Recognize and identify basic blueprint terms, components, and symbols. |
| __ | __ | __ | __ | 2. Relate information on blueprints to actual locations on the print. |
| __ | __ | __ | __ | 3. Recognize different classifications of drawings. |
| __ | __ | __ | __ | 4. Interpret and use drawing dimensions. |

MODULE F: BASIC RIGGING (Optional)

- | | | | | |
|----|----|----|----|---|
| 3 | 2 | 1 | N | |
| __ | __ | __ | __ | 1. Explain how ropes, chains, hoists, loaders, and cranes are used to move material and equipment from one location to another on a job site. |
| __ | __ | __ | __ | 2. Describe inspection techniques and load-handling safety practices. |

- — — — 3. Explain the American National Standards Institute (ANSI) hand signals.

MODULE G: BASIC COMMUNICATION SKILLS
(SDE Requirement)

3 2 1 N

- — — — 1. Explain techniques for communicating effectively with coworkers and supervisors.
- — — — 2. Demonstrate verbal and written communication skills necessary in the workplace.
- — — — 3. Demonstrate telephone and e-communication skills necessary in the workplace.

MODULE H: BASIC EMPLOYABILITY SKILLS
(SDE Requirement)

3 2 1 N

- — — — 1. Identify the roles of individuals and companies in the construction industry.
- — — — 2. Explain the importance critical thinking and problem solving skills in the workplace.
- — — — 3. Describe computer systems and their industry applications.
- — — — 4. Explain interpersonal relationship skills, self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.

WELDING 1, 2, 3, and 4

UNIT A: WELDING SAFETY

3 2 1 N

- — — — 1. Identify some common hazards in welding.
- — — — 2. Explain and identify proper personal protection used in welding.
- — — — 3. Demonstrate how to avoid welding fumes.
- — — — 4. Explain some of the causes of accidents.
- — — — 5. Identify and explain uses for material safety data sheets.
- — — — 6. Demonstrate safety techniques for storing and handling cylinders.
- — — — 7. Explain how to avoid electric shock

when welding.

- — — — 8. Demonstrate proper material handling methods.

UNIT B: OXYFUEL CUTTING

3 2 1 N

- — — — 1. Identify and explain the use of oxyfuel cutting equipment.
- — — — 2. Set up oxyfuel equipment.
- — — — 3. Light and adjust an oxyfuel torch.
- — — — 4. Shut down oxyfuel cutting equipment.
- — — — 5. Disassemble oxyfuel equipment.
- — — — 6. Change empty cylinders.
- — — — 7. Perform oxyfuel cutting:
Straight line and square shapes
Piercing and slot cutting
Bevels
Washing
Gouging
- — — — 8. Operate a motorized, portable oxyfuel gas cutting machine.

UNIT C: BASE METAL PREPARATION

3 2 1 N

- — — — 1. Clean base metal for welding or cutting.
- — — — 2. Identify and explain joint design.
- — — — 3. Explain joint design considerations.
- — — — 4. Using a nibbler, cutter, or grinder, mechanically prepare the edge of a mild steel plate ¼" to ¾" thick at 22½° (or 30° depending on equipment available).
- — — — 5. Using a nibbler, cutter, or grinder, mechanically prepare the end of a pipe with a 30° or 37½° bevel (depending on equipment available) and a 3/32" land. Use 6", 8", or 10" Schedule 40 or Schedule 80 mild steel pipe.
- — — — 6. Select the proper joint design based on a welding procedure specification (WPS) or instructor direction.

UNIT D: SMAW – EQUIPMENT AND SETUP

3 2 1 N

- — — — 1. Identify and explain shielded metal arc welding (SMAW) safety.
- — — — 2. Identify and explain welding electrical current.

- — — — 3. Identify and explain arc welding machines.
- — — — 4. Explain setting up arc welding equipment.
- — — — 5. Set up a machine for welding.
- — — — 6. Identify and explain tools for weld cleaning.

UNIT E: SMAW – ELECTRODES AND SELECTION

3 2 1 N

- — — — 1. Identify factors that affect electrode selection.
- — — — 2. Explain the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME) filler metal classification system.
- — — — 3. Identify different types of filler metals.
- — — — 4. Explain the storage and control of filler metals.
- — — — 5. Explain filler metal traceability requirements and how to use applicable code requirements.
- — — — 6. Identify and select the proper electrode for an identified welding task.

UNIT F: SMAW – BEADS AND FILLET WELDS

3 2 1 N

- — — — 1. Set up shielded metal arc welding (SMAW) equipment.
- — — — 2. Describe methods of striking an arc.
- — — — 3. Properly strike and extinguish an arc.
- — — — 4. Describe causes of arc blow and wander.
- — — — 5. Make stringer, weave, and overlapping beads.
- — — — 6. Make fillet welds in the:
Horizontal (2F) position
Vertical (3F) position
Overhead (4F) position

UNIT G: SMAW – GROOVE WELDS WITH BACKING

3 2 1 N

- — — — 1. Identify and explain groove welds.
- — — — 2. Identify and explain groove welds with backing.

- ___ ___ ___ 3. Set up shielded metal arc welding (SMAW) equipment for making V-groove welds.
- ___ ___ ___ 4. Perform SMAW for V-groove welds with backing in the:
 - Flat (1G) position
 - Horizontal (2G) position
 - Vertical (3G) position
 - Overhead (4G) position

UNIT H: JOINT FIT-UP AND ALIGNMENT

- 3 2 1 N
- ___ ___ ___ 1. Identify and explain job code specifications.
 - ___ ___ ___ 2. Use fit-up gauges and measuring devices to check joint fit-up.
 - ___ ___ ___ 3. Identify and explain distortion and how it is controlled.
 - ___ ___ ___ 4. Fit up joint using plate and pipe fit-up tools.
 - ___ ___ ___ 5. Check for joint misalignment and poor fit-up before and after welding.

UNIT I: WELDING SYMBOLS

- 3 2 1 N
- ___ ___ ___ 1. Identify and explain the various parts of a welding symbol.
 - ___ ___ ___ 2. Identify and explain fillet and groove weld symbols.
 - ___ ___ ___ 3. Read welding symbols on drawings, specifications, and welding procedure specifications.
 - ___ ___ ___ 4. Interpret welding symbols from a print.
 - ___ ___ ___ 5. Draw welding symbols based on the observation of actual welds.

UNIT J: READING WELDING DETAIL DRAWINGS

- 3 2 1 N
- ___ ___ ___ 1. Identify and explain a welding detail drawing.
 - ___ ___ ___ 2. Identify and explain lines, material fills, and sections.
 - ___ ___ ___ 3. Identify and explain object views.
 - ___ ___ ___ 4. Identify and explain dimensioning.
 - ___ ___ ___ 5. Identify and explain notes and bill of materials.
 - ___ ___ ___ 6. Interpret basic elements of a welding detail drawing.
 - ___ ___ ___ 7. Develop basic welding drawings.

UNIT K: PLASMA ARC CUTTING (PAC)

- 3 2 1 N
- ___ ___ ___ 1. Identify and understand plasma arc cutting processes.
 - ___ ___ ___ 2. Identify plasma arc cutting equipment.
 - ___ ___ ___ 3. Prepare and set up plasma arc cutting equipment.
 - ___ ___ ___ 4. Use plasma arc cutting equipment to make various types of cuts.
 - ___ ___ ___ 5. Properly store equipment and clean the work area after use.

UNIT L: GMAW AND FCAW – EQUIPMENT AND FILLER METALS

- 3 2 1 N
- ___ ___ ___ 1. Explain gas metal arc welding (GMAW) and flux cored arc welding (FCAW) safety.
 - ___ ___ ___ 2. Explain the characteristics of welding current and power sources.
 - ___ ___ ___ 3. Identify and explain the use of GMAW and FCAW equipment:
 - Spray transfer
 - Globular
 - Short circuiting
 - Pulse
 - ___ ___ ___ 4. Identify and explain the use of GMAW and FCAW shielding gases and filler metals.
 - ___ ___ ___ 5. Set up GMAW and FCAW equipment and identify tools for weld cleaning

UNIT M: GMAW AND FCAW – PLATE

- 3 2 1 N
- ___ ___ ___ 1. Perform GMAW multiple-pass fillet welds on plate, using solid or composite wire and shielding gas in multiple positions.
 - ___ ___ ___ 2. Perform GMAW multiple-pass open-root V-groove welds on plate, using solid or composite wire and shielding gas, in multiple positions.
 - ___ ___ ___ 3. Perform GMAW spray fillet and open-root V-groove welds on plate, using solid or composite wire and shielding gas, in flat and horizontal positions.
 - ___ ___ ___ 4. Perform FCAW multiple-pass fillet welds on plate in multiple positions using flux cored wire and, if required, shielding gas.
 - ___ ___ ___ 5. Perform FCAW multiple-pass open-root V-groove welds on plate in

multiple positions using flux cored wire and, if required, shielding gas.

WELDING – ADVANCED

For schools with more classroom instructional hours, choose from the list of advanced standards.

ADVANCED UNIT A: WELD QUALITY

- 3 2 1 N
- ___ ___ ___ 1. Identify and explain codes governing welding.
 - ___ ___ ___ 2. Identify and explain weld imperfections and their causes.
 - ___ ___ ___ 3. Identify and explain nondestructive examination practices.
 - ___ ___ ___ 4. Identify and explain welder qualification tests.
 - ___ ___ ___ 5. Explain the importance of quality workmanship.
 - ___ ___ ___ 6. Identify common destructive testing methods.

ADVANCED UNIT B: SMAW – OPEN V-GROOVE WELDS

- 3 2 1 N
- ___ ___ ___ 1. Prepare shielded metal arc welding (SMAW) equipment for open-root V-groove welds.
 - ___ ___ ___ 2. Perform open-root V-groove welds in the:
 - Flat (1G) position
 - Horizontal (2G) position
 - Vertical (3G) position
 - Overhead (4G) position

ADVANCED UNIT C: SMAW – OPEN-ROOT PIPE WELDS

- 3 2 1 N
- ___ ___ ___ 1. Prepare shielded metal arc welding (SMAW) equipment for open-root V-groove pipe welds.
 - ___ ___ ___ 2. Identify and explain open-root V-groove pipe welds.
 - ___ ___ ___ 3. Perform SMAW for open-root welds in the:
 - Flat (1G-ROTATED) position
 - Horizontal (2G) position
 - Multiple (5G) position
 - Multiple inclined (6G) position

ADVANCED UNIT D: AIR CARBON ARC CUTTING AND GOUGING

- 3 2 1 N
__ __ __ __
1. Identify and explain the air carbon arc cutting (CAC-A) process and equipment.
 2. Select and install CAC-A electrodes.
 3. Prepare the work area and CAC-A equipment for safe operation.
 4. Use CAC-A equipment for washing and gouging activities.
 5. Perform storage and housekeeping activities for CAC-A equipment.
 6. Make minor repairs to CAC-A equipment.

ADVANCED UNIT E: GTAW – EQUIPMENT AND FILLER METALS

- 3 2 1 N
__ __ __ __
1. Explain gas tungsten arc welding (GTAW) safety.
 2. Identify and explain the use of GTAW equipment.
 3. Identify and explain the use of GTAW filler metals.
 4. Identify and explain the use of GTAW shielding gases.
 5. Set up GTAW equipment.

ADVANCED UNIT F: GTAW – PLATE

- 3 2 1 N
__ __ __ __
1. Build a pad in the flat position with stringer beads using GTAW and carbon steel filler metal.
 2. Make multiple-pass open-root V-groove welds on carbon steel plate in the 1G (flat) position using GTAW and carbon steel filler metal.
 3. Make multiple-pass open-root V-groove welds on carbon steel plate in the 2G (horizontal) position using GTAW and carbon steel filler metal.
 4. Make multiple-pass open-root V-groove welds on carbon steel plate in the 3G (vertical) position using GTAW and carbon steel filler metal.
 5. Make multiple-pass open-root V-groove welds on carbon steel plate in the 4G (overhead) position using GTAW and carbon steel filler metal.

ADVANCED UNIT G: GTAW – ALUMINUM PLATE

- 3 2 1 N
__ __ __ __
1. Identify and explain aluminum metallurgy.
 2. Explain and identify characteristics of aluminum.
 3. Explain GTAW and set up equipment to weld aluminum plate.
 4. Explain and practice GTAW techniques for plate, including padding in the flat position with stringer beads, using aluminum filler metal.
 5. Make fillet welds on aluminum plate in the following positions:
1F (flat)
2F (horizontal)
3F (vertical)
4F (overhead)
 6. Make multiple-pass V-groove welds with backing on aluminum plate in the following positions:
1G (flat)
2G (horizontal)
3G (vertical)
4G (overhead)

ADVANCED UNIT H: GAS TUNGSTEN ARC WELDING (GTAW) – CARBON STEEL PIPE

- 3 2 1 N
__ __ __ __
1. Set up GTAW equipment.
 2. Identify and explain open-root V-groove pipe weld techniques.
 3. Perform open-root V-groove pipe welds using GTAW in the following positions:
1G-ROTATED
2G
5G
6G

ADVANCED UNIT I: GAS TUNGSTEN ARC WELDING (GTAW) – LOW-ALLOY AND STAINLESS STEEL PIPE

- 3 2 1 N
__ __ __ __
1. Set up GTAW equipment to perform stainless and/or low-alloy steel pipe welding.
 2. Identify and explain open-root V-groove pipe weld techniques.
 3. Perform open-root V-groove pipe welds using GTAW in the following

positions:
1G-ROTATED
2G
5G
6G