

Pacing Guide

Welding 1 (semester)

Week 1

A. *STUDENT ORGANIZATIONS*

Effective professionals know the academic subject matter, including professional development, required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study. 1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO). 2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses. 3. Explain the benefits and responsibilities of being a member of a CTSO. 4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities. 5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

B. *TECHNOLOGY KNOWLEDGE*

Effective professionals know the academic subject matter, including the ethical use of technology as needed in their role. The following accountability criteria are considered essential for students in any program of study. 1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation. 2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes. 3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks. 4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; cyberbullying, illegal downloading; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment). 5. Discuss legal issues and the terms of use related to copyright laws, fair use laws, and ethics pertaining to downloading of images, photographs, documents, video, sounds, music, trademarks, and other elements for personal use. 6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information. 7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

C. *PERSONAL QUALITIES AND EMPLOYABILITY SKILLS*

Effective professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study. 1. Demonstrate punctuality. 2. Demonstrate self-representation. 3. Demonstrate work ethic. 4. Demonstrate respect. 5. Demonstrate time management. 6. Demonstrate integrity. 7. Demonstrate leadership. 8. Demonstrate teamwork and collaboration. 9. Demonstrate conflict resolution. 10. Demonstrate perseverance. 11. Demonstrate commitment. 12. Demonstrate a healthy view of competition. 13. Demonstrate a global perspective. 14. Demonstrate health and fitness. 15. Demonstrate self-direction. 16. Demonstrate lifelong learning.

D. *PROFESSIONAL KNOWLEDGE*

Effective professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study. 1. Demonstrate effective speaking and listening skills. 2. Demonstrate effective reading and writing skills. 3. Demonstrate mathematical reasoning. 4. Demonstrate job-specific mathematics skills. 5. Demonstrate critical-thinking and problem-solving skills. 6. Demonstrate creativity and resourcefulness. 7. Demonstrate an understanding of business ethics. 8. Demonstrate confidentiality. 9. Demonstrate an understanding of workplace structures, organizations, systems, and climates. 10. Demonstrate diversity awareness. 11. Demonstrate job acquisition and advancement skills. 12. Demonstrate task management skills. 13. Demonstrate customer-service skills.

E. *NCCER CONTREN CORE MODULES*

Effective construction professionals demonstrate basic safety knowledge as needed in their role. The following accountability criteria are considered essential for students in all the construction programs of study. 1. Identify the responsibilities and personal characteristics of a professional craftsman. 2. Describe the safe work requirements for elevated work. 3. Identify and explain how to avoid struck-by and caught-in-between hazards. 4. Explain the appropriate safety precautions around common job-site hazards. 5. Demonstrate the use and care of appropriate personal protective equipment (PPE). 6. Identify and describe other specific job-site safety hazards. 7. Follow safe procedures for lifting heavy objects. 8. Describe safe behavior on and around ladders and scaffolds. 9. Explain the importance of the Hazard Communication Standard (HazCom) requirement and Safety Data Sheets (SDS) 10. Describe fire prevention and firefighting techniques. 11. Define safe work procedures around electrical hazards. 12. Complete 10-hour OSHA course/assessment and receive card. (SDE Requirement) 13. Complete Performance Tasks

F. *00102-15: BASIC MATH*

Effective construction professionals demonstrate basic math skills as needed in their role. The following accountability criteria are considered essential for students in all the construction programs of study. 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 percent and percent 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.

G. *00103-15: INTRODUCTION TO HAND TOOLS*

Effective construction professionals demonstrate how to safely use various hand tools as needed in their role. The following accountability criteria are considered essential for students in all the construction programs of study. 1. Recognize and identify various types of basic hand tools used in the construction trade. 2. Identify and describe how to use various types of measurement and layout tools. 3. Identify and explain how to use various types of cutting and shaping tools. 4. Use these tools safely. 5. Describe the basic procedures for taking care of these tools. 6. Complete Performance Tasks

Week 2

H. *00104-15: INTRODUCTION TO POWER TOOLS*

Effective construction professionals demonstrate how to safely use power tools as needed in their role. The following accountability criteria are considered essential for students in all the construction programs of study. 1. Identify and explain how to use various types of power drills and impact wrenches used in the construction trade. 2. Identify and explain how to use various types of power saws. 3. Identify and explain how to use various grinders and grinder attachments. 4. Identify and explain how to use miscellaneous power tools. 5. Use power tools safely. 6. Explain how to maintain power tools properly. 7. Complete Performance Tasks

I. *00105-15: INTRODUCTION TO CONSTRUCTION DRAWINGS*

Effective construction professionals demonstrate knowledge and the use of blueprints/construction drawings as needed in their role. The following accountability criteria are considered essential for students in the plumbing program of study. 1. Identify and describe various types of construction drawings, including their fundamental components and features. 2. Recognize and identify basic blueprint terms, components, and symbols. 3. Relate information on blueprints to actual locations on the print. 4. Recognize different classifications of drawings. 5. Interpret and use drawing dimensions. 6. Complete Performance Tasks

J. *00106-15: BASIC RIGGING (Optional)*

Effective construction professionals demonstrate how to use basic rigging as needed in their role. The following accountability criteria are considered essential for students in the plumbing program of study. 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. 4. Complete Performance Tasks

K. *00107-15: BASIC COMMUNICATION SKILLS (SDE Requirement)*

Effective construction professionals demonstrate appropriate communication skills as needed in their role. The following accountability criteria are considered essential for students in all of the construction programs of study. 1. Describe the communication, listening and speaking processes and their relationship to job performance. 2. Describe good reading and writing skills and their relationship to job performance. 3. Demonstrate telephone and e-communication skills necessary in the workplace. 4. Complete Performance Tasks

A. *WELDING SAFETY*

Effective welders demonstrate appropriate safety skills. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

Week 3

B. *OXYFUEL CUTTING*

Effective welders demonstrate appropriate skills for oxyfuel cutting. They will use this knowledge as needed in their role. The following accountability criteria are considered essential

for students in the Welding Technology program of study. 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.

Week 5

C. *BASE METAL PREPARATION*

Effective welders demonstrate appropriate skills for base metal preparation. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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 $\frac{1}{4}$ " to $\frac{3}{4}$ " thick at $22\frac{1}{2}^\circ$ (or 30° depending on equipment available). 5. Using a nibbler, cutter, or grinder, mechanically prepare the end of a pipe with a 30° or $37\frac{1}{2}^\circ$ bevel (depending on equipment available) and a $\frac{3}{32}$ " 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.

D. *SMAW – EQUIPMENT AND SETUP*

Effective welders demonstrate appropriate skills using arc welding. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

E. *SMAW – ELECTRODES AND SELECTION*

Effective welders demonstrate knowledge and use of metals in welding. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

Week 6

F. *SMAW – BEADS AND FILLET WELDS*

Effective welders demonstrate knowledge and use of metals in welding. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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

Week 12

G. SMAW – GROOVE WELDS WITH BACKING

Effective welders demonstrate appropriate groove welding skills. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

H. JOINT FIT-UP AND ALIGNMENT

Effective welders demonstrate appropriate joint fit-up and alignment skills in welding. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

Week 13

I. WELDING SYMBOLS

Effective welders demonstrate knowledge and use of welding symbols. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

J. READING WELDING DETAIL DRAWINGS

Effective welders demonstrate knowledge and skills for reading and interpreting welding detail drawings. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

K. PLASMA ARC CUTTING (PAC)

Effective welders demonstrate appropriate plasma arc cutting skills in welding. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

Week 14

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

A. *WELD QUALITY*

Effective welders demonstrate knowledge of quality welding. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.

B. *SMAW – OPEN V-GROOVE WELDS*

Effective welders demonstrate appropriate knowledge and skills in using shielded metal arc welding for open V-groove welds. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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

C. *AIR CARBON ARC CUTTING AND GOUGING*

Effective welders demonstrate appropriate knowledge and skills for air carbon arc cutting process and equipment. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in the Welding Technology program of study. 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.