

INTRODUCTION TO WELDING

COURSE DESCRIPTION

*Introduction to Welding** is a course in which students will learn basic skills and knowledge related to cutting and welding applications. Course content includes safe practices, career research, leadership development, and basic arc welding and thermal cutting skills. Combined with the second and third year courses, *Basic Principles of Welding* and *Welding Applications and Certification*, the student should be prepared for *Entry Level Welder Certification*, as defined by American Welding Society QC10.

It is strongly recommended that administration and guidance follow the scope and sequence and course recommendations as listed.

Recommended Credits: 1

Recommended Grade Level(s): 9th or 10th

Number of Competencies in Course: 52

Note: *This course may be offered as a part of the Construction or the Manufacturing Sub-Clusters, depending upon the student's career focus. Construction Core is recommended for students in the Construction Sub-Cluster, but it is not required for students in the Manufacturing.

INTRODUCTION TO WELDING

STANDARDS

- 1.0** Students will assume responsibility for the safety of themselves, their coworkers, and bystanders.
- 2.0** Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.
- 3.0** Students will integrate reading, writing, math, and science skills and understand the impact of academic achievement in the workplace.
- 4.0** Students will evaluate career opportunities and career paths within the welding industry.
- 5.0** Students will safely store, operate, and maintain welding equipment and accessories.
- 6.0** Students will relate the properties of metals to weldments and the welding processes.
- 7.0** Students will perform thermal-cutting operations.
- 8.0** Students will pad beads on carbon steel plate in the flat, horizontal, vertical, and overhead positions using a shielded metal arc welding (SMAW) process.

INTRODUCTION TO WELDING

STANDARD 1.0

Students will assume responsibility for the safety of themselves, their coworkers, and bystanders.

LEARNING EXPECTATIONS

The student will:

- 1.1** Demonstrate a positive attitude regarding safety practices and issues.
- 1.2** Use and inspect personal protective equipment.
- 1.3** Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.4** Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.5** Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.6** Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards.
- 1.7** Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures.
- 1.8** Demonstrate appropriate related safety procedures.
- 1.9** Pass with 100 % accuracy a written examination relating to safety issues
- 1.10** Pass with 100% accuracy a performance examination relating to safety.
- 1.11** Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 1.1A** Is attentive during safety discussions.
- 1.1B** Actively seeks information about safe procedures.
- 1.1C** Responds positively to instruction, advice, and correction regarding safety issues.
- 1.1D** Does not deliberately create or increase hazards, such as by horseplay, practical jokes, or creating distractions.
- 1.1E** Reports to school or work physically ready to perform to professional standards, such as rested, or not impaired by medications, drugs, or alcohol.
- 1.2** Selects, inspects, and uses the correct personal protective equipment for the assigned task.
- 1.3A** Inspects power tools for intact guards, shields, insulation, and other protective devices.
- 1.3B** Inspects extension cords for the presence of a functional ground connection prior to use.
- 1.3C** Operates and maintains tools in accordance with manufacturer's instructions and as required by regulation or company policy.
- 1.3D** Properly places and secures ladders and scaffolding prior to use.
- 1.4A** Is observant of personnel and activities in the vicinity of the work area.
- 1.4B** Warns nearby personnel prior to starting potentially hazardous actions.

- 1.5A** When asked to use a new hazardous material, retrieves MSDSs (material safety data sheets) and identifies the health hazards associated with the new material.
- 1.5B** Reports hazards found on the job site to the supervisor.
- 1.6A** Erects shields, barriers, and signage to protect coworkers and bystanders prior to starting potentially hazardous tasks.
- 1.6B** Provides and activates adequate ventilation equipment as required by the task.
- 1.7A** Reports all injuries to self to the immediate supervisor.
- 1.7B** Reports observed unguarded hazards to their immediate supervisor.
- 1.8** Complies with personal assignments regarding emergency assignments.
- 1.9** Passes with 100% accuracy a written examination relating specifically to content area.
- 1.10** Passes with 100% accuracy a performance examination relating specifically to welding tools, equipment, and supplies.
- 1.11** Maintains a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

SAMPLE PERFORMANCE TASKS

These are sample projects of the type and scale recommended to address one or more of the learning expectations for this standard. Other projects can be used at the instructor's discretion.

- Conduct a practice drill simulating a hazardous solvent spill in which an emergency action plan is to be implemented.
- Instruct a visitor to obviously approach the vicinity of a student conducting a hazardous activity and note the level of awareness demonstrated by the student.
- For a project requiring the use of ladders and/or scaffolding, note the proper placement and securing procedures followed by students.

INTEGRATION LINKAGES

Language Arts, Mathematics, Algebra, Geometry English, SkillsUSA Technical Championships, American Welding Society (AWS), Guide for Training and Qualification of Entry Level Welder, National Center for Construction Education Research (NCCER), Secretary's Commission on Achieving Necessary Skills (SCANS), Professional Development Program, SkillsUSA

INTRODUCTION TO WELDING

STANDARD 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 2.1** Cultivate positive leadership skills.
- 2.2** Participate in the student organization directly related to their program of study as an integral part of classroom instruction.
- 2.3** Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.4** Participate as a team member in a learning environment.
- 2.5** Respect the opinions, customs, and individual differences of others.
- 2.6** Build personal career development by identifying career interests, strengths, and opportunities.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 2.1A** Demonstrates character and leadership using creative-and critical-thinking skills.
- 2.1B** Uses creative thought process by “thinking outside the box.”
- 2.2A** Relates the creed, purposes, motto, and emblem of their student organization to personal and professional development.
- 2.2B** Plans and conducts meetings and other business according to accepted rules of parliamentary procedure.
- 2.3A** Makes decisions and assumes responsibilities.
- 2.3B** Analyzes a situation and uses the Professional Development Program or career and technical student organization materials directly related to the student’s program of study to resolve it.
- 2.3C** Understands the importance of learning new information for both current and future problem solving and decision making.
- 2.4A** Organizes committees and participates in functions.
- 2.4B** Cooperates with peers to select and organize a community service project.
- 2.5A** Researches different customs and individual differences of others.
- 2.5B** Interacts respectfully with individuals of different cultures, gender, and backgrounds.
- 2.5C** Resolves conflicts and differences to maintain a smooth workflow and classroom environment.
- 2.6A** Creates personal career development by identifying career interests, strengths, and opportunities.
- 2.6B** Identifies opportunities for career development and certification requirements.

- 2.6C** Plans personal educational paths based on available courses and current career goals.
- 2.6D** Creates a resume that reflects student's skills, abilities, and interests.

SAMPLE PERFORMANCE TASKS

- Create a leadership inventory and use it to conduct a personal assessment.
- Participate in various career technical student organizations' programs and/or competitive events.
- Implement an annual program of work.
- Prepare a meeting agenda for a specific career and technical student organization monthly meeting.
- Attend a professional organization meeting.
- Develop a program of study within their career opportunities.
- Participate in the American Spirit Award competition with SkillsUSA.
- Complete *Professional Development Program Level I and Level II*, SkillsUSA.

INTEGRATION LINKAGES

SkillsUSA, *Professional Development Program*; SkillsUSA; Communications and Writing Skills; Teambuilding Skills; Research; Language Arts; Sociology; Psychology; Math; English; Social Studies; Problem Solving; Interpersonal Skills; Employability Skills; Critical-Thinking Skills; Secretary's Commission on Achieving Necessary Skills (SCANS); Chamber of Commerce; Colleges; Universities; Technology Centers; Secretary's Commission on Achieving Necessary Skills (SCANS)

INTRODUCTION TO WELDING

STANDARD 3.0

Students will integrate reading, writing, math, and science skills and understand the impact of academic achievement in the work place.

LEARNING EXPECTATIONS

The student will:

- 3.1 Assume responsibility for accomplishing classroom assignments and workplace goals within accepted time frames.
- 3.2 Develop advanced study skills.
- 3.3 Demonstrate and use written and verbal communication skills.
- 3.4 Read and understand technical documents such as regulations, manuals, reports, forms, graphs, charts, and tables.
- 3.5 Apply the foundations of mathematical principles such as algebra, geometry, and advanced math to solve problems.
- 3.6 Apply basic scientific principles and methods to solve problems and complete tasks.
- 3.7 Demonstrate an understanding of computer operations and related applications to input, store, retrieve, and output information as it relates to the course.
- 3.8 Research, recognize, and understand the interactions of the environment and *green* issues as they relate to the course work and to a global economy.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 3.1A Uses appropriate time management to achieve goals.
- 3.1B Arrives at school on time each day.
- 3.1C Completes assignments and meets deadlines.
- 3.2A Assesses current personal study skills.
- 3.2B Demonstrates advanced note-taking ability.
- 3.2C Formulates appropriate study strategies for given tasks.
- 3.3A Communicates ideas, information, and messages in a logical manner.
- 3.3B Fills out forms, time sheets, reports, logs, and documents to comply with class and project requirements.
- 3.4A Reads and understands technical documents and uses industry jargon, acronyms, and terminology appropriately.
- 3.4B Recognizes the meaning of specialized words or phrases unique to the career and industry.
- 3.5A Utilizes computation in adding, subtracting, multiplying, and dividing of whole numbers, fractions, decimals, and percents.
- 3.5B Chooses the right mathematical method or formula to solve a problem.
- 3.5C Performs math operations accurately to complete classroom and lab tasks.
- 3.6A Demonstrates an understanding of scientific principles critical to the course.

- 3.6B** Applies scientific principles and technology to solve problems and complete tasks.
- 3.6C** Demonstrates knowledge of the scientific method (e.g., identifies the problem, collects information, forms opinions, and draws conclusions).
- 3.7A** Uses basic computer hardware (e.g., PCs, printers) and software to perform tasks as required for the course work.
- 3.7B** Demonstrates an understanding of capabilities of computers and common computer terminology (e.g., program, operating system).
- 3.7C** Applies the appropriate technical solution to complete tasks.
- 3.7D** Inputs data and information accurately for the course requirements.
- 3.8A** Researches and recognizes *green* trends in career area and industry.
- 3.8B** Examines current environmentally friendly trends.
- 3.8C** Applies sustainability practices by understanding processes that are non-polluting, conserving of energy and natural resources, and economically efficient.

SAMPLE PERFORMANCE TASKS

- Examine and compile different learning styles for portfolios.
- Create calendars containing all activities and obligations for one month. Discuss how to handle conflicting or competing obligations then complete daily and weekly plans showing tasks, priorities, and scheduling.
- Complete self-assessments of study habits.
- Compute precise and exact measurements.
- Explore study strategies for different subjects and tasks then analyze two homework assignments and select the best strategies for completing them.
- Create “life maps” showing necessary steps or “landmarks” along the path to personal, financial, educational, and career goals.
- Take notes during counselor classroom visits and work in small groups to create flow charts of the path options.
- List attitudes that lead to success then rate individually in these areas. Work together to suggest strategies for overcoming the weaknesses identified own and partners’ self-assessments then share with the class the strategies developed.
- Research the Internet and other resources to collect and analyze data concerning climate change.
- Keep a data file of alternative energy sources and the sources’ impact on the environment.
- Develop a recycling project at home or for the school environment.

INTEGRATION LINKAGES

SkillsUSA, *Professional Development Program*; SkillsUSA; Communications and Writing Skills; Teambuilding Skills; Research; Language Arts; Sociology; Psychology; Math; English; Social Studies; Problem Solving; Interpersonal Skills; Employability Skills; Critical-Thinking Skills; Secretary’s Commission on Achieving Necessary Skills (SCANS); Chamber of Commerce; Colleges; Universities; Technology Centers; Secretary’s Commission on Achieving Necessary Skills (SCANS)

INTRODUCTION TO WELDING

STANDARD 4.0

Students will evaluate career opportunities and career paths within the welding industry.

LEARNING EXPECTATIONS

The student will:

- 4.1** Explain titles, roles, and functions of individuals in the welding industry.
- 4.2** Investigate employment and entrepreneurial opportunities in the welding industry.
- 4.3** Evaluate personal characteristics required for working in the welding industry.
- 4.4** Investigate post-secondary education, professional organizations, and trade publications appropriate for continuing education.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 4.1A** Researches occupations within the welding industry.
- 4.1B** Categorizes major responsibilities for each occupation in the welding industry.
- 4.2A** Researches and develops a projection of industry trends related to career opportunities in the welding industry.
- 4.3A** Profiles personal characteristics that are beneficial to the success of a professional in the welding industry.
- 4.4A** Investigates career options and charts the characteristics of various careers in the welding industry.
- 4.4B** Researches, sets up and maintains a file outlining professional organizations, current issues, future trends, and emerging technologies in the welding industry.
- 4.4C** Researches and locates information on post-secondary schools that offer welding training.

SAMPLE PERFORMANCE TASKS

These are sample projects of the type and scale recommended to address one or more of the learning expectations for this standard. Other projects can be used at the instructor's discretion.

- Categorize employment and entrepreneurial opportunities (listing salary).
- Develop a profile of career opportunities, educational requirements, and projected future employment.
- Develop a personal career plan.
- Appraise professional welding industry organizations and explain their purposes.
- Incorporate professional terminology into conversation.
- Attend meetings of a related professional trade organization.

INTEGRATION LINKAGES

SkillsUSA, *Professional Development Program*, SkillsUSA, *Total Quality Management*, SkillsUSA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Algebra, Geometry, English, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, SCANS (Secretary's Commission on Achieving Necessary Skills), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies, American Welding Society (AWS)

INTRODUCTION TO WELDING

STANDARD 5.0

Students will safely store, operate, and maintain welding equipment and accessories.

LEARNING EXPECTATIONS

The student will:

- 5.1** Implement and comply with ANSI Z49.1, *Safety and Welding, Cutting, and Allied Processes* and Occupational Safety and Health Administration (OSHA) requirements for operating each piece of equipment.
- 5.2** Demonstrate required safety practices while operating all equipment and tools.
- 5.3** Exhibit acceptable dress and personal grooming as identified by the welding industry.
- 5.4** Demonstrate the use of basic metal working and welding equipment.
- 5.5** Evaluate the importance and use of ventilation.
- 5.6** Properly handle welding gas cylinders.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 5.1A** Passes with 100% accuracy a written safety examination relating to the applicable sections of ANSI Z49.1, *Safety and Welding, Cutting, and Allied Processes* and Occupational Safety and Health Administration (OSHA) requirements.
- 5.1B** Demonstrates compliance with ANSIZ49.1 as it relates to protection of personnel in the general area, ventilation, fire prevention and protection, precautionary information, and general aspects.
- 5.1C** Establishes and maintains a working environment incorporating the principles of ANSI Z49.1, *Safety and Welding, Cutting, and Allied Processes*.
- 5.1D** Analyzes fire prevention, electrical and safety methods to be incorporated with the use of welding equipment.
- 5.1E** Completes a safety inspection introducing HazCom confined space and lockout/tagout implications.
- 5.2A** Maintains a portfolio record of equipment for which the student has passed an examination covering the operation of welding equipment and tools.
- 5.2B** Maintains a portfolio record of equipment for which the student has passed an operational checkout by the instructor.
- 5.3A** Compares and contrasts appropriate and inappropriate dress and personal grooming characteristics for specific jobs in the welding industry.
- 5.3B** Uses appropriate dress, eye/face protection, gloves, and other protective devices as required by ANSI Z49.1, *Safety and Welding, Cutting, and Allied Processes*.
- 5.4A** Demonstrates grinding, sawing, and drilling operations within the tolerance specified on a drawing or blueprint.
- 5.5A** Uses ventilating equipment, safety shields, and curtains as required by ANSI Z49.1, *Safety and Welding, Cutting, and Allied Processes*.

- 5.5B** Develops and administers formative or diagnostic tests for proper ventilation.
- 5.6A** Stores welding gas cylinders in an upright and secure position.
- 5.6B** Operates with welding gas cylinders in an upright and secured position.

SAMPLE PERFORMANCE TASKS

- Write a report on potential skin and eye damage caused by ultraviolet radiation produced by arc welding processes.
- Participate in a job interview where a portfolio is used to show welding equipment and tools that the student has received an operational checkout by the instructor and grades on written examinations of the operation of welding equipment and tools
- Look up MSDS for welding fluxes, shielding compounds, and filler materials to assess the risks of toxic gas release and acidity in the school welding shop.
- Demonstrate the proper handling and transportation of compressed gas cylinders.
- Simulate use of fire extinguisher.
- Appraise the work area for safety hazards and list common causes of typical accidents and injuries in the welding industry. Based on the findings of the appraisal, outline a safety corrections program and present the program to the school and professional organizations.
- Cut, saw, and drill holes in metal.

INTEGRATION LINKAGES

Language Arts, Mathematics, English, Algebra, Geometry, SkillsUSA Technical Championships, American Welding Society (AWS), Guide for Training and Qualification of Entry Level Welder, National Center for Construction Education Research (NCCER), Secretary's Commission on Achieving Necessary Skills (SCANS), *Professional Development Program*, SkillsUSA

INTRODUCTION TO WELDING

STANDARD 6.0

Students will relate the properties of metals to weldments and the welding processes.

LEARNING EXPECTATIONS

The student will:

- 6.1** Evaluate the mechanical properties of metals and their importance in welding processes.
- 6.2** Analyze the thermal properties of metals and their effects on welding processes.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 6.1A** Compares and contrasts the meaning of tensile strength, hardness, elasticity, ductility, toughness, and brittleness.
- 6.1B** Describes the changes in mechanical properties of weldments that can occur during the welding process.
- 6.1C** Conducts destructive and non-destructive tests of mechanical properties of weldments.
- 6.2A** Describes and demonstrates techniques to mitigate the effects of thermal expansion and contraction that occur during welding processes.
- 6.2B** Explains the changes that can occur in the mechanical properties of weld and parent metals caused by the heating and cooling during welding.
- 6.2C** Compares the thermal conductivity of various metals, such as steel and aluminum, and explains effect of thermal conductivity on heat and cooling rates observed during welding.
- 6.2D** Compares the specific heats of various metals, such as steel and aluminum, and explains the effect of specific heat on heat rates required for welding.

SAMPLE PERFORMANCE TASKS

- Develop a presentation or demonstration showing the mechanical and thermal properties of metals.
- Show results of comparisons of metals for tensile strength, hardness, elasticity, ductility, toughness, and brittleness.
- Explain the best use of each metal for various projects.
- Present the above information to the school, community, or professional organizations.

INTEGRATION LINKAGES

Language Arts, Mathematics, Algebra, Geometry, English, SkillsUSA Technical Championships, American Welding Society (AWS), Guide for Training and Qualification of Entry Level Welder, National Center for Construction Education Research (NCCER), Secretary's Commission on Achieving Necessary Skills (SCANS), *Professional Development Program*, SkillsUSA, Occupational Safety and Health Administration (OSHA)

INTRODUCTION TO WELDING

STANDARD 7.0

Students will perform thermal-cutting operations (oxyfuel, plasma-arc, and air carbon arc cutting).

LEARNING EXPECTATIONS

The student will:

- 7.1 Identify and explain safety procedures, equipment, equipment set up, and techniques that apply to oxyfuel cutting.
- 7.2 Identify and explain safety procedures, equipment, equipment set up, and techniques that apply to plasma-arc cutting.
- 7.3 Identify and explain safety procedures, equipment set up, and techniques that apply to air carbon arc gouging.
- 7.4 Prepare layouts for cutting individual parts.
- 7.5 Perform manual straight, shaped, and beveled cutting operations using thermal-cutting processes.
- 7.6 Perform machine-guided straight, shaped (where possible), and beveled cutting operations using thermal-cutting processes.
- 7.7 Use weld-washing techniques.
- 7.8 Perform gouging operations using air carbon arc cutting process on plain carbon steel.
- 7.9 Visually examine the thermal cut surfaces for conditions meeting the assignment specifications.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 7.1A Safely assembles, set-up, light, and adjust oxyfuel cutting equipment.
- 7.1B Safely shuts down and disassembles oxyfuel cutting equipment.
- 7.2A Safely prepares and sets-up plasma-arc cutting equipment.
- 7.3A Safely prepares and sets-up air carbon arc cutting equipment.
- 7.4A Utilizes rulers, straightedges, chalklines, and other layout equipment to make a layout suitable for guiding a cutting operation.
- 7.4B Uses principles of algebra and geometry to assist in complex layout operations.
- 7.5A Accurately cuts straight parts using the manual oxyfuel cutting process.
- 7.5B Accurately cuts shaped parts using the manual oxyfuel gas-cutting process.
- 7.5C Accurately cuts beveled parts using the manual oxyfuel gas-cutting process.
- 7.5D Accurately cuts straight parts using the manual plasma-arc cutting process.
- 7.5E Accurately cuts shaped parts using the manual plasma-arc cutting process.
- 7.5F Accurately cuts beveled parts using the manual plasma-arc cutting process.
- 7.6A Accurately produces parts involving machine-guided straight, shaped (where possible), and beveled cuts using thermal cutting processes.
- 7.7A Removes tack welds using oxyfuel cutting weld-washing techniques.

- 7.7B** Washes out the defective weld material using oxyfuel cutting process.
- 7.8A** Removes metal as required by the job assignment using the air carbon arc cutting process on plain carbon steel.
- 7.9A** Visually examines thermal cut surfaces for conditions meeting the assignment's specifications.

SAMPLE PERFORMANCE TASKS

- Prepare a layout of a rectangular part and verify squareness of the layout by measuring diagonals.
- Prepare a layout of an acute angle using linear measurements and trigonometric relationships.
- Prepare a layout for an elliptical part when given dimensions of the major and minor axes.
- Using thermal-cutting equipment, cut metal plate parts for the assembly of a rectangular metal tank.
- Using thermal-cutting equipment, cut metal plate parts for the assembly of a silhouette metal sign.
- Using thermal cutting equipment, cut a length of metal pipe, beveling the ends for the purpose of joining the pipe with groove welds.
- Identify a faulty alignment in a tack-welded assembly, use weld-washing techniques to remove the tack weld, and correct the alignment.
- Backgouge groove welds to ensure complete joint penetration.

INTEGRATION LINKAGES

Writing and Communication Skills, Teamwork and Leadership Skills, Language Arts, Mathematics, Art, Blueprint Reading, Computer Skills, Internet Skills, Algebra, Geometry, SkillsUSA Technical Championships, American Welding Society (AWS), Guide for Training and Qualification of Entry Level Welder, National Center for Construction Education Research (NCCER), Secretary's Commission on Achieving Necessary Skills (SCANS), *Professional Development Program*, SkillsUSA, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA)

INTRODUCTION TO WELDING

STANDARD 8.0

Students will pad beads on carbon steel plate in the flat, horizontal, vertical, and overhead positions using a shielded metal arc welding (SMAW) process.

LEARNING EXPECTATIONS

The student will:

- 8.1** Identify and explain safety procedures, equipment, equipment set up, and electrical current that apply to shielded metal arc welding.
- 8.2** Identify and explain classifications and electrode selection for shielded metal arc welding.
- 8.3** Pad beads using various electrodes in the flat position.
- 8.4** Pad beads using various electrodes in the horizontal position.
- 8.5** Pad beads using various electrodes in the vertical position.
- 8.6** Pad beads using various electrodes in the overhead position.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 8.1A** Safely sets-up equipment for shielded metal arc welding.
- 8.1B** Identifies and explains SMAW safety.
- 8.1C** Identifies and explains direct current (dc) and alternating current (ac).
- 8.1D** Identifies and explains shielded metal arc welding power sources.
- 8.2A** Identifies factors that affect electrode selection.
- 8.2B** Explains the American Welding Society (AWS) filler metal classification system.
- 8.3A** Pads beads using various electrodes on plain carbon steel in the flat position.
- 8.4A** Pads Beads using various electrodes on plain carbon steel in the horizontal position.
- 8.5A** Pads beads using various electrodes on plain carbon steel in a vertical position.
- 8.6A** Pads beads using various electrodes on plain carbon steel in an overhead position.

SAMPLE PERFORMANCE TASKS

- Complete projects to enhance the learning activity. Integrate related academic skills and knowledge to design, layout, and fabricate a welding project.
- Practice for the Entry-Level Welder Certification.

INTEGRATION LINKAGES

Language Arts, Mathematics, Algebra, Geometry, SkillsUSA Technical Championships, American Welding Society (AWS), Guide for Training and Qualification of Entry Level Welder, National Center for Construction Education Research (NCCER), Secretary's Commission on Achieving Necessary Skills (SCANS), Professional Development Program, SkillsUSA