Chapter 389 of NAC

LCB File No. T039-05

ADOPTED TEMPORARY REGULATION OF THE STATE BOARD OF EDUCATION

Filed with the Secretary of State on May 18, 2005.

STATE SKILL STANDARDS
METALWORKING

Career & Technical Education

Skills for Employment & Lifelong Learning

CTE

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State Board for Occupational Education on

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Introduction

The Department of Education has undertaken an ambitious effort to develop statewide occupational skill standards. The standards in this document are for Metalworking programs and are designed to clearly state what the student should know and be able to do upon completion of an advanced high-school program.

The writing team determined that any statewide skill standards for programs that teach metalworking should be designed to teach entry-level and advanced skills related to the construction of a single-family residence. The standards cover the following areas: (1) Safety; (2) Measurement and Layout; (3) Metallurgy; (4) Tools and Machines; (5) Welding; (6) Sheet Metal; (7) Machine Tools; (8) Employability Skills. The standards also include the math skills students need to be successful in the industry.

These exit-level standards are designed for advanced programs, for students completing at minimum a two-year metalworking program. Students at the appropriate level of instruction will be expected to demonstrate competence for all performance indicators in the "meets standard" domains for each performance standard. Teachers are encouraged to use them for to focus curriculum objectives for entry-level programs, also.

The standards are organized as follows:

Content Standards are general statements that identify major areas of knowledge, understanding, and skills students are expected to learn in key subject and career areas by the end of the program.

Following each Content Standard are a number of **Performance Standards**. Performance Standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.

Each Performance Standard is analyzed into specific **Performance Indicators**. Performance Indicators are very specific criteria statements for determining whether a student exceeds the standard, meets the standard, or whose performance approaches the standard. Performance Indicators may also be used as learning outcomes which teachers can identify as they plan their program learning objectives.

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Content and Performance Standards
General Shop Safety

Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the metals lab.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 1.1	**The student will demonstrate adherence to general shop safety rules including but not limited to those listed in the following performance indicators.**
EXCEEDS STANDARD	• Customize or develop a shop safety program. • Obtains certification in First Aid/CPR. • Provide a shop safety demonstration to students.
MEETS STANDARD	1.1.1 Pass safety test. 1.1.2 Identify and utilize proper storage for flammables. 1.1.3 Identify ventilation hazards and take corrective action. 1.1.4 Demonstrate the ability to keep a clean, orderly, and safe work area. 1.1.5 Demonstrate safe use of personal protective equipment. 1.1.6 Demonstrate safe use of machines, tools, and equipment. 1.1.7 Portray safe behaviors/attitudes while in the working environment. 1.1.8 Explain proper steps in reporting an injury/accident or emergency. 1.1.9 Demonstrate proper lifting techniques. 1.1.10 Identify and use hearing protection when needed. 1.1.11 Explain the purpose OSHA. 1.1.12 Demonstrate the safe handling of compressed gases under the direct supervision of the instructor.
APPROACHES STANDARD	• Read safety requirements found in the metalworking lab. • Identify safety procedures of machines, tools, and equipment. • Identify safe behaviors/attitudes. • List different types of hearing protection.

Nevada Academic Standards Correlation: Science: 24.12.1, 24.12.2, 24.12.3

Content and Performance Standards
General Shop Safety

Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the metals lab.

Performance Standard 1.2	**The student will demonstrate adherence to specific shop fire safety rules and procedures including but not limited to those listed in the following performance indicators.**
EXCEEDS STANDARD	• Create a fire safety program.
MEETS STANDARD	1.2.1 Describe the use of fire extinguishers / blankets. 1.2.2 Discuss the various types of fires Class A, B, C and D. 1.2.3 Demonstrate fire evacuation procedures. 1.2.4 Discuss and list potential fire hazards related to metalworking. 1.2.5 Demonstrate use of ventilation system controls in the metalworking lab. 1.2.6 Demonstrate proper storage of flammable materials.
APPROACHES STANDARD	• Read fire safety requirements found in the metalworking lab. • Identify fire evacuation procedures. • Identify all locations of fire extinguishers, safety blankets, and exit routes.

Nevada Academic Standards Correlation: Science: 20.12.5, 24.12.1, 24.12.2

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 2.1	**Students will use measuring tools to complete required lab assignments.**
EXCEEDS STANDARD	• Demonstrate use of metric measuring devices to one millimeter. • Demonstrate appropriate measuring techniques to peers.
MEETS STANDARD	2.1.1 Demonstrate the use of semi-precision measuring devices to 1/64”. 2.1.2 Demonstrate the use of precision measuring devices to include micrometers and vernier calipers to 0.001”.
APPROACHES STANDARD	• Identify semi-precision measuring devices. • Identify precision measuring devices.

Nevada Academic Standards Correlation: Math: 3.12.2, 3.12.3

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

Performance Standard 2.2	**Students will be able to use and apply layout tools to complete required lab projects.**
EXCEEDS STANDARD	• Layout complex shapes and angles other than 45º and 90º.
MEETS STANDARD	2.2.1 Demonstrate use of a combination square set, dividers, scratch awls, layout dye, soap stone, framing square, levels, trammel points and center punch. 2.2.2 Demonstrate use of bar and c-clamps, jigs, and fixtures. 2.2.3 Layout basic shapes and angles.
APPROACHES STANDARD	• Identify common layout tools. • Observe a video and/or demonstration on layout tools and techniques.

Nevada Academic Standards Correlation: Math: 3.12.2, 3.12.3, 3.12.5

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

Performance Standard 2.3	**Students will be able to interpret basic prints and develop a working drawing.**
EXCEEDS STANDARD	• Draw orthographic projections with an isometric or oblique view. • Identify twenty blueprint acronyms and symbols.
MEETS STANDARD	2.3.1 Develop a paper pattern as it applies to a sheet metal project. 2.3.2 Interpret symbols as they apply to working drawings. 2.3.3 Use orthographic projections to complete a working drawing.
APPROACHES STANDARD	• Differentiate between a working drawing and an orthographic projection.

Nevada Academic Standards Correlation: Math: 3.12.2, 3.12.5, 4.12.1, 4.12.7, 4.12.8, 9.6, 9.8

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

Performance Standard 2.4	**Students will be able to apply basic mathematical skills common to the metalworking industry.**
EXCEEDS STANDARD	• Apply math solutions in the metalworking lab using geometry.
MEETS STANDARD	2.4.1 Apply math solutions using whole numbers, fractions, and decimals as they relate to metalworking lab projects. 2.4.2 Solve mathematical problems using handbooks, tables, charts, and graphs.
APPROACHES STANDARD	• Identify whole numbers, fractions, and decimals.

Nevada Academic Standards Correlation:
Math: 1.12.1, 1.12.3, 6.13, 8.11, 9.6, 9.7, 9.8
Science: 23.12.2

Content and Performance Standards
Metallurgy

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 3.1	**Students will identify metal types and shapes.**
EXCEEDS STANDARD	• Demonstrate magnet and file test. • Identify characteristics of metal alloys.
MEETS STANDARD	3.1.1 Perform a spark test to determine ferrous or non-ferrous metals. 3.1.2 Identify metals such as steel, cast iron, aluminum, stainless steel, copper, brass, and zinc. 3.1.3 Define properties used to identify common metals (i.e. tensile strength, hardness, malleability, ductility). 3.1.4 List the five most common shapes of metal. 3.1.5 Identify thickness by using a wire gage.
APPROACHES STANDARD	• Describe metal making processes. • Observe a metal making process video.

Nevada Academic Standards Correlation:
Math: 3.12.2;
English: 7.12.5
Science: 2.12.1

Content and Performance Standards
Metallurgy

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals common to industry.

Performance Standard 3.2	**Students will describe and apply the principles of metallurgy as they apply to hardening and annealing.**
EXCEEDS STANDARD	• Demonstrate the tempering process.
MEETS STANDARD	3.2.1 Demonstrate the hardening process. 3.2.2 Demonstrate the annealing process. 3.2.3 Demonstrate safe methods of handling hot metals.
APPROACHES STANDARD	• Explain the difference between tempering, hardening, and the annealing processes.

Nevada Academic Standards Correlation: Science: 3.12.1, 24.12.1

Content and Performance Standards
Metallurgy

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals common to industry.

Performance Standard 3.3	**Students will describe the effects of heating and cooling of metals to be fabricated.**
EXCEEDS STANDARD	• Demonstrate how metal is deformed during heating and cooling.
MEETS STANDARD	3.3.1 Describe expansion and contraction as a result of heating and cooling metals. 3.3.2 Demonstrate safe methods of handling hot metals.
APPROACHES STANDARD	• Recognize hot materials in the metalworking lab.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Tools and Machines

Content Standard 4.0: Students will safely operate commonly used metalworking machines, and tools.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 4.1	**Students will identify and safely operate stationary power machines commonly used in the metals lab.**
EXCEEDS STANDARD	• Perform non-electrical preventative maintenance on machinery to comply with **safety** requirements.
MEETS STANDARD	4.1.1 Demonstrate safe work practices for stationary power machines, including but not limited to: grinders, buffers, sanders, band saws, chop saws, shears, and presses.
APPROACHES STANDARD	• Identify basic stationary power machines such as grinders, buffers, sanders, band saws, chop saws, shears, and presses. • Identify safety features of basic stationary power machines such as grinders, buffers, sanders, band saws, chop saws, shears, and presses. • Observe safety video and demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Tools and Machines

Content Standard 4.0: Students will safely operate commonly used metalworking machines, and tools.

Performance Standard 4.2	**Students will identify and safely operate portable power machines commonly found in the metals lab.**
EXCEEDS STANDARD	• Perform non-electrical preventative maintenance on portable power machines to comply with safety requirements.
MEETS STANDARD	4.2.1 Demonstrate safe work practices for portable power machines, including but not limited to: grinders, buffers, sanders, band saws, shears, and drills.
APPROACHES STANDARD	• Identify basic portable power machines such as grinders, buffers, sanders, band saws, shears, and drills. • Identify safety features of basic portable power machines such as grinders, buffers, sanders, band saws, shears, and drills. • Observe safety video and demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Tools and Machines

Content Standard 4.0: Students will safely operate commonly used metalworking machines, and tools.

Performance Standard 4.3	**Students will identify and safely use hand tools commonly found in the metals lab.**
EXCEEDS STANDARD	• Perform non-electrical preventative maintenance on chisels and punches to comply with safety requirements.
MEETS STANDARD	4.3.1 Demonstrate safe work practices for hand tools, including but not limited to: pliers, files, chisels, punches, hard face and soft face hammers, hacksaw, vises, and brushes.
APPROACHES STANDARD	• Identify basic hand tools such as pliers, files, chisels, punches, hard face and soft face, hammers, hacksaw, vises, and brushes. • Identify safety features of basic hand tools such as pliers, files, chisels, punches, hard face and soft face, hammers, hacksaw, vises, and brushes.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Welding Techniques

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 5.1	**Students will identify, list, and demonstrate use of proper personal safety equipment.**
EXCEEDS STANDARD	• Clean and maintain personal protective safety gear. • Develop a personal safety checklist.
MEETS STANDARD	5.1.1 Identify and list personal safety equipment in the metalworking lab. 5.1.2 Demonstrate appropriate use of personal safety equipment necessary to complete assigned projects. 5.1.3 Demonstrate the proper use of ventilation. 5.1.4 Demonstrate the proper use of personal respiration equipment.
APPROACHES STANDARD	• Observe a safety video and/or demonstration. • List personal protective safety equipment.

Nevada Academic Standards Correlation:
Science: 24.12.1
English: 7.12.5

Content and Performance Standards
Welding Techniques

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Performance Standard 5.2	**Students will demonstrate the set-up and operation of oxy-fuel welding and cutting equipment.**
EXCEEDS STANDARD	• Demonstrate the safe handling and storage of compressed gas cylinders under the direct supervision of the instructor. • Demonstrate piercing, slotting, and bevel cutting techniques. • Complete a NIOSH safety check list.
MEETS STANDARD	5.2.1 Identify, select, and set-up oxy-fuel welding and cutting equipment. 5.2.2 Select and safely operate oxy-fuel welding and cutting equipment used to complete assigned projects. 5.2.3 Lay-out, cut, and fit materials (such as pipe, plate, and structural shapes). 5.2.4 Identify safe handling procedures of cylinders according to OSHA standards. 5.2.5 Demonstrate proper methods of cleaning and care of oxy-fuel welding and cutting tips. 5.2.6 Identify, select, and use proper filler materials.
APPROACHES STANDARD	• List oxy-fuel welding and cutting equipment used to complete assigned projects. • Identify the various types of gas cylinders.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 4.12.7, 6.2, 6.9, 9.7, 9.8;
Science: 24.12.1

Content and Performance Standards
Welding Techniques

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Performance Standard 5.3	**Students will demonstrate the set-up and operation of Shielded Metal Arc Welding (SMAW) equipment.**
EXCEEDS STANDARD	• Demonstrate appropriate SMAW techniques to peers. • Identify SMAW problems, their causes, and take corrective action.
MEETS STANDARD	5.3.1 Identify, select, and set-up SMAW equipment. 5.3.2 Select and **safely** operate SMAW equipment used to complete assigned projects. 5.3.3 Select appropriate electrodes to complete assignments.
APPROACHES STANDARD	• List SMAW equipment. • Observe SMAW video and/or demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Welding Techniques

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Performance Standard 5.4	**Students will demonstrate the set-up and operation of Gas Metal Arc Welding (GMAW) equipment.**
EXCEEDS STANDARD	• Demonstrate appropriate GMAW techniques to peers. • Identify GMAW problems, their causes, and take corrective action.
MEETS STANDARD	5.4.1 Identify, select, and set-up GMAW equipment. 5.4.2 Select and **safely** operate GMAW equipment used to complete assigned projects. 5.4.3 Select appropriate wire and gas to complete assignments. 5.4.4 Select, set-up, and **safely** operate Flux Core Arc Welding (FCAW) equipment.
APPROACHES STANDARD	• List GMAW / FCAW equipment. • Observe GMAW video and/or demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Welding Techniques

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Performance Standard 5.5	**Students will demonstrate the set-up and operation of Gas Tungsten Arc Welding (GTAW) equipment.**
EXCEEDS STANDARD	• Demonstrate appropriate GTAW techniques to peers. • Identify GTAW problems, their causes, and take corrective action. • Demonstrate ability to weld aluminum.
MEETS STANDARD	5.5.1 Identify, select, and set-up GTAW equipment. 5.5.2 Select and **safely** operate GTAW equipment used to complete assigned projects. 5.5.3 Select appropriate electrodes and filler materials to complete assignments. 5.5.4 Select appropriate gas to complete GTAW assignments.
APPROACHES STANDARD	• List GTAW equipment. • Observe GTAW video and/or demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Welding Techniques

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Performance Standard 5.6	**Students will demonstrate the set-up and operation of plasma arc cutting equipment.**
EXCEEDS STANDARD	• Demonstrate appropriate plasma arc cutting techniques to peers. • Identify plasma arc cutting problems, their causes, and take corrective action.
MEETS STANDARD	5.6.1 Set-up and **safely** operate plasma arc cutting equipment used to complete assigned projects. 5.6.2 Use appropriate ventilation or personal respirator to complete assignments.
APPROACHES STANDARD	• List plasma arc cutting equipment. • Observe a plasma arc cutting demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Sheet Metal

Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 6.1	**Students will demonstrate pattern development and layout techniques.**
EXCEEDS STANDARD	• Demonstrate the use of radial line, parallel line, and triangulation development. • Demonstrate how to find true length lines.
MEETS STANDARD	6.1.1 Construct paper patterns for a simple sheet metal project. 6.1.2 Layout directly on metal using dyes, scribes, dividers, trammel points, and edge gages. 6.1.3 Identify edges and seams used in typical sheet metal layout. 6.1.4 Demonstrate the use of a sheet metal gage.
APPROACHES STANDARD	• Identify sheet metal layout tools. • Observe a demonstration(s).

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 3.12.5, 4.12.1, 4.12.7, 4.12.8, 6.2, 6.9, 9.7, 9.8

Content and Performance Standards
Sheet Metal

Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.

Performance Standard 6.2	**Students will identify and demonstrate the use of sheet metal forming machines and hand tools.**
EXCEEDS STANDARD	• Demonstrate the ability to make a Pittsburg seam by hand. • Perform basic preventative non-electrical maintenance on machines and tools to comply with **safety** requirements for optimal performance levels.
MEETS STANDARD	6.2.1 Form sheet metal using a box and pan break, bar folder, slip roll, and a rotary machine for an assigned project. 6.2.2 Cut sheet metal using foot shears, hand shears, Beverly shear, and Whitney punches for an assigned project. 6.2.3 Use appropriate cutting and folding techniques to complete assigned project.
APPROACHES STANDARD	• Identify the various types of shears, breaks, and folders.

Content and Performance Standards
Sheet Metal

Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.

Performance Standard 6.3	**Students will identify and demonstrate the use of various sheet metal fastening techniques.**
EXCEEDS STANDARD	• Join metal together using a Pittsburg seam. • Join metal together using low temperature solder.
MEETS STANDARD	6.3.1 Demonstrate the ability to join sheet metal together with rivets, resistance welding, and seaming techniques. 6.3.2 Identify and list the various sheet metal fastening techniques.
APPROACHES STANDARD	• Identify types of rivets and seams.

Nevada Academic Standards Correlation: English: 7.12.5

Content and Performance Standards
Machine Tools

Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 7.1	**Students will set-up and safely operate the metal cutting lathe.**
EXCEEDS STANDARD	• Demonstrate the ability to turn a taper using one of the three taper cutting techniques. • Demonstrate the ability to cut threads. • Demonstrate the ability to center a tailstock. • Demonstrate the ability to indicate a work piece in a four-jaw chuck. • Demonstrate the ability to use a boring bar.
MEETS STANDARD	7.1.1 Identify basic components of lathes. 7.1.2 Use charts and tables to determine cutting, drilling, and knurling speeds. 7.1.3 Select proper cutting tool based on job requirements. 7.1.4 Demonstrate the ability to **safely** face, straight turn, shoulder turn, center drill, and knurl a work piece. 7.1.5 Demonstrate ability to **safely** sharpen cutting tools.
APPROACHES STANDARD	• List the basic components of lathes. • List the different cutting tools. • Observe a demonstration(s).

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 3.12.5;
Science: 23.12.2, 24.12.1

Content and Performance Standards
Machine Tools

Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.

Performance Standard 7.2	**Student will set-up and safely operate milling machines.**
EXCEEDS STANDARD	• Locate an edge with edge finder. • Mill an external radius with a rotary table. • Mill a work piece using simple indexing operation.
MEETS STANDARD	7.2.1 Identify all of the components of vertical milling machines. 7.2.2 Demonstrate the ability to **safely** apply work securing devices. 7.2.3 Use charts and tables to determine feeds and speeds. 7.2.4 Select appropriate cutting tool based on assigned project. 7.2.5 Demonstrate the ability to **safely** mill to a specified size.
APPROACHES STANDARD	• List the components of the vertical milling machine. • List the different cutting tools used in the milling process.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 3.12.5;
Science: 23.12.2, 24.12.1

Content and Performance Standards
Machine Tools

Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.

Performance Standard 7.3 Students will set-up and safely operate the drill press.	
EXCEEDS STANDARD	• Demonstrate the ability to large hole drill. • Demonstrate the ability to drill to depth.
MEETS STANDARD	7.3.1 Identify components of the drill press. 7.3.2 Set up and securely clamp a work piece to the drill press table. 7.3.3 Use charts and tables to determine cutting speeds and feeds for drilling a specific medium. 7.3.4 Select appropriate drill type based on job requirements. 7.3.5 Use bench grinder to sharpen drill bits. 7.3.6 Demonstrate proper dress and observe **safe** operating procedures while using the drill press.
APPROACHES STANDARD	• List the components of the drill press. • Observe demonstration.

Nevada Academic Standards Correlation: Science: 24.12.1

Content and Performance Standards
Employability Skills

Content Standard 8.0*:* **Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

Performance Standard 8.1	Students shall demonstrate problem-solving skills.
EXCEEDS STANDARD	• Develop methods to analyze the advantages and disadvantages of alternative solutions. • Devise an action plan for a metalworking problem based on information gained through research of alternative solutions and implement in a group decision/action.
MEETS STANDARD	8.1.1 Solve a metalworking problem using the appropriate steps in the problem-solving process. 8.1.2 Demonstrate brainstorming techniques. 8.1.3 Examine and explain the advantages and disadvantages of alternative solutions to one or more problems. 8.1.4 Create an action plan based upon a solution to a metalworking problem. 8.1.5 Identify the benefits of solving a metalworking problem.
APPROACHES STANDARD	• Identify the basic steps in the problem-solving process. • Identify alternative solutions to a problem. • Identify the basic components of an action plan.

Academic Standards Correlation:
Math: 6.12.7, 6.12.13, 7.12.1, 7.12.6, 7.12.14
Science 22.12.2, 24.12.5
English 4.12.6, 6.12.2, 10.12.2, 10.12.3

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.2	Students shall demonstrate critical-thinking skills.
EXCEEDS STANDARD	• Analyze how critical thinking skills affect work performance. • Formulate, implement, and evaluate an action plan. • Demonstrate the skills necessary to identify, analyze, and solve a design problem.
MEETS STANDARD	8.2.1 Identify and explains the essential elements of the critical thinking process as related to the metalworking trades. 8.2.2 Demonstrate critical thinking skills necessary in the metalworking trades. 8.2.3 Explain how emotional thinking and logical thinking affect decision making in the metalworking trades. 8.2.4 Explain the difference between reliable and unreliable observations and statements of facts. 8.2.5 Recognize patterns or relationships through observation and discovery.
APPROACHES STANDARD	• State the importance of critical thinking in identifying, analyzing, and solving a metalworking problem. • Identify the essential steps of critical thinking. • Define emotional and logical thinking. • Identify the difference between opinions and statements of fact.

Academic Standards Correlation:
Math: 2.12.6, 5.12.4
English: 10.12.1

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.3	Students shall demonstrate the ability to speak, write, and listen effectively.
EXCEEDS STANDARD	• Identify research, prepare and deliver a metalworking related presentation. • Prepare technical documents relating to bill of materials, blueprints, etc. • Present and defend a metalworking procedure. • Compete in a SkillsUSA job skill demonstration and/or public speaking contest
MEETS STANDARD	8.3.1. Explain the benefits of effective communication skills in the workplace. 8.3.2. Effectively interpret and responds to verbal and nonverbal messages. 8.3.3. Demonstrate proper telephone etiquette. 8.3.4. Effectively communicates thoughts, ideas and information in writing. 8.3.5. Organize ideas and communicate orally; is able to effectively demonstrate job skills to others. 8.3.6. Locate, understand and interpret written information in documents such as manuals, graphs and schedules. 8.3.7. Select and utilize an appropriate medium for conveying messages with dignity and respect. 8.3.8. Organize information into the appropriate format in accordance with standard practices, which includes prewriting, drafting, proofreading, editing/revising, and preparing final copy. 8.3.9. Demonstrate sensitivity to cultural diversity in communication. 8.3.10. Identify common communication barriers and methods for improving communication.

APPROACHES STANDARD	• Define communications. • Explain the benefits of effective communication in the metalworking trade. • Explain how cultural and physical diversity effect communication. • Identify applicable medium for conveying messages.

Academic Standards Correlation:
Math: 5.12.1
English: 4.12.6, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.4	**Students shall demonstrate the ability to select, apply and maintain appropriate technology**
EXCEEDS STANDARD	• Critique the use, benefits and cost of technologically advanced equipment in the metalworking trade. • Analyze the impact of technological changes on one or more aspects of metalworking trades by researching current literature. • Compete in a state-level SkillsUSA metalworking contest.
MEETS STANDARD	8.4.1. Demonstrate ability to utilize basic keyboarding techniques. 8.4.2. Demonstrate ability to utilize other input devices. 8.4.3. Demonstrate ability to utilize various electronic research methods. 8.4.4. Demonstrate knowledge of the basic technology systems currently available and how they apply to your field (i.e. word processing, spreadsheets, multimedia applications and databases). 8.4.5. Investigate and explain the use, benefits, and costs of technological developments in the workplace and school. 8.4.6. Identify and demonstrate the appropriate use of technology to enhance the efficiency of the workplace and school. 8.4.7. Demonstrate routine maintenance and repair of technological equipment.
APPROACHES STANDARD	• Recognize technology used in the metalworking trade. • Use an Internet browser to locate specific Websites related to metalworking trades.

Academic Standards Correlation: Math: 3.12.4

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.5	Students shall demonstrate leadership and teamwork skills.
EXCEEDS STANDARD	• Analyze the stages of group development. • Demonstrate leadership ability within a group or team. • Compromise and/or build consensus within a group and summarize the decision of the group while maintaining respect for diverse viewpoints. • Complete levels 1-3 of the SkillsUSA Professional Development Program. • Campaign for a local SkillsUSA chapter office. • Serve as a committee chair in a local SkillsUSA chapter.
MEETS STANDARD	8.5.1. Work cooperatively with others when given group project. 8.5.2. Explain traits necessary to effectively lead and influence individuals and groups. 8.5.3. Demonstrate appropriate attitudes and behaviors for effective leadership. 8.5.4. Demonstrate respect for team members, team processes, and team goals. 8.5.5. Participate in the implementation of a group's decision and evaluates the results. 8.5.6. Demonstrate the qualities of an effective leader and team member. 8.5.7. Describe the importance of a proper dress code.
APPROACHES STANDARD	• Explain the importance of groups. • Explain how to organize groups. • Wear appropriate attire.

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.6 Students shall demonstrate sound workplace ethics.	
EXCEEDS STANDARD	• Demonstrate time-management skills and cost-effective practices.
MEETS STANDARD	8.6.1. Develop personal work ethics through work experience. 8.6.2. Describe the importance of ethics practiced in the workplace. 8.6.3. Demonstrate regular attendance, promptness, and the willingness to follow instructions and complete an assigned task. 8.6.4. Demonstrate appropriate personal and professional attitudes and behaviors. 8.6.5. Maintain a safe, clean, and organized work area. 8.6.6. Demonstrate awareness of legal responsibilities related to individual performance, safety, and customer satisfaction. 8.6.7. Demonstrate knowledge of various types of harassment.
APPROACHES STANDARD	• List the important ethics in the workplace. • Meet attendance standards. • Describe an organized workplace. • Identify appropriate responses to unethical actions.

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.7	Students shall demonstrate the ability to effectively manage resources in high-performance workplaces.
EXCEEDS STANDARD	• Recognize the individual roles of team members, delegate tasks, and provide feedback on performance. • Acknowledge and utilize the skills, abilities, and input of all members of a team. • Develop an action plan to accomplish tasks within a given time frame.
MEETS STANDARD	8.7.1. Develop a time schedule and prioritized task list to complete a job assignment. 8.7.2. Identify the resources needed to complete a job assignment. 8.7.3. Organize the material resources and space requirements needed to complete a job assignment. 8.7.4. Effectively use technology to complete a job assignment. 8.7.5. Demonstrate cooperation and leadership as a team at school or in a workplace setting. 8.7.6. Use the basic components of effective time management. 8.7.7. Recognize the need for management skills in the workplace with regard to stress, anger management, and substance abuse.
APPROACHES STANDARD	• List effective time management skills. • Use technology to complete assignments. • Utilize materials, tools, and processes to complete a task related to a career selection. • Read and follow instructions from manuals on the use and care of materials, tools, and equipment. • Maintain a clean, organized, and **safe** job site. • Identify traits needed for cooperation and leadership in a team at school or in a workplace setting. • Identify the material resources and space requirements needed to complete an assignment.

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.8	Students shall demonstrate career planning and development skills.
EXCEEDS STANDARD	• Develop a community service or job shadowing project. • Develop an education/training plan to fulfill long-term career goals. • Define advantages and disadvantages of self-employment or working for various sizes and types of businesses. • Critique results of a job interview. • Develop a proposal for an organized community service project. • Compete in a state level SkillsUSA job interview contest.
MEETS STANDARD	8.8.1. Prepare a job application. 8.8.2. Prepare a personal resume. 8.8.3. Complete a personal aptitude and interest inventory. 8.8.4. Participate in a mock job interview. 8.8.5. Establish short-term career goals. 8.8.6. Establish long-term career goals. 8.8.7. Use the Nevada Career Information System (CIS) or a similar computer-based program to research careers in a chosen field. 8.8.8. Participates in an organized job-shadowing activity. 8.8.9. Participate in a community service project. 8.8.10. Construct a career portfolio.
APPROACHES STANDARD	• Locate employment opportunities. • Identify job requirements for entry-level positions in the metalworking industry. • Identify general conditions for employment. • Identify educational/training requirements for related metalworking fields. • Identify the elements of goal setting. • Identify metalworking related careers. • Describe essential job interview skills. • Identify the components of a career portfolio.

Academic Standards Correlation:
English: 5.12.5, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5, 9.12.1

Content and Performance Standards
Employability Skills

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.9	Students shall demonstrate job-retention and lifelong-learning skills.
EXCEEDS STANDARD	• Maintain an electronic portfolio. • Create a plan for lifelong learning. • Create a presentation illustrating interpersonal skills needed for job retention. • Adapt new knowledge and skills in changing situations. • Analyze how work life is affected by families and how families are affected by work life.
MEETS STANDARD	8.9.1. Maintain an employment/career portfolio. 8.9.2. Explain strategies for balancing work and family roles. 8.9.3. Demonstrate understanding of the need for lifelong learning in a rapidly changing job market. 8.9.4. Describe strategies to maintain employment in the face of job reductions. 8.9.5. Develop long-term career planning strategies. 8.9.6. Describe various educational options needed for job retention. 8.9.7. Model sound workplace ethics, such as loyalty, punctuality, and initiative. 8.9.8. Demonstrates interpersonal skills needed for job retention.
APPROACHES STANDARD	• Describe the importance of a portfolio. • Identify options for lifelong learning. • Identify interpersonal skills needed for job retention. • Identify jobs with opportunity for advancement. • Describe the importance of career planning.

Academic Standards Correlation:
English: 5.12.5, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5

CROSSWALK OF METALWORKING STANDARDS AND ACADEMIC STANDARDS

Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the metals lab.

Performance Indicators	Academic Standards
1.1.6	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards. 24.12.2 Use the information found in materials safety data sheets to handle, store, and dispose of chemicals properly. 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment.
1.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
1.2.4	**Science** 20.12.5 Identify the type of hazard, estimate the extent and consequences of exposure, and determine the options for reducing or eliminating risks.
1.2.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
1.2.6	**Science** 24.12.2 Use the information found in materials safety data sheets to handle, store, and dispose of chemicals properly.

Content Standard 2.0: Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.

2.1.1, 2.1.2	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.

2.2.1	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.
2.2.3	**Math** 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.
2.3.1. 2.3.3	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost distances, interest, temperatures, and weight/mass. **Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.** 4.12.1 Identify and use the properties of polygons and elements of circles to solve practical problems. 4.12.7 Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems. 4.12.8 Construct, justify and defend mathematical conclusion using logical, sequential, deductive reasoning supported by established mathematical principles. 9.6 Use and analyze the connections between Mathematics and other disciplines. 9.8 Identify, explain, and use mathematics in everyday life.
2.4.1, 2.4.2	**Math** 1.12.1 Calculate and estimate sums, differences, products, quotients, powers, and roots using mental math, formulas, and algorithms. 1.12.3 Apply the properties and theories of the real number system to everyday situations. 6.13 Use technology, including calculators, to solve problems and

	verify solutions. 8.11 Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems. 9.6 Use and analyze the connections between Mathematics and other disciplines. 9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines 9.8 Identify, explain, and use mathematics in everyday life. **Science** 23.12.2 Use algebraic equations when appropriate.

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals.

3.1.2	**Science** 2.12.1 Investigate and describe intrinsic (color, odor, density) and extrinsic (e.g., size, mass, volume) physical properties of matter.
3.1.4	**Science** 2.12.1 Investigate and describe intrinsic (color, odor, density) and extrinsic (e.g., size, mass, volume) physical properties of matter. **English** 7.12.5 Demonstrate conventional spelling.
3.1.5	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.
3.2.1, 3.2.2	**Science** 3.12.1 Explain that the transformation of energy usually results in some energy in the form of heat, which spreads by radiation, conduction, and sometimes convection into cooler places.
3.2.3	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
3.3.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 4.0: Students will safely operate commonly used metalworking machines, and tools.

4.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
4.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
4.3.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

5.1.1	**English** 7.12.5 Demonstrate conventional spelling.
5.1.2, 5.13, 5.1.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.1, 5.2.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.3	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 4.12.7 Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems. 6.2 Apply previous experience and knowledge to new problem-solving situations. 6.9 Generalize solutions and strategies from earlier problems to new problem situations.

	9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines. 9.8 Identify, explain, and use mathematics in everyday life.
5.2.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.3.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.4.2, 5.4.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.5.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.6.1, 5.6.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.

6.1.1	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems. 4.12.1 Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arcs, chords, secants and tangents) to solve practical problems. 4.12.8 Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures.

	6.2 Apply previous experience and knowledge to new problem-solving situations. 6.9 Generalize solutions and strategies from earlier problems to new problem situations. 9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science). 9.8 Identify, explain, and use mathematics in everyday life.
6.1.2	**<u>Math</u>** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. **Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.** 4.12.1 Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arcs, chords, secants and tangents) to solve practical problems 4.12.7 Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems. **Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures.** 6.1 Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts. 6.2 Apply previous experience and knowledge to new problem-solving situations. 6.9 Generalize solutions and strategies from earlier problems to new problem situations. 9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines. 9.8 Identify, explain, and use mathematics in everyday life.
6.3.2	**<u>English</u>** 7.12.5 Demonstrate conventional spelling.

Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.

7.1.2	**23.12.2 Science** 23.12.2 Use algebraic equations when appropriate.
7.1.4, 7.1.5	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems. **Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
7.2.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
7.2.3	**Science** 23.12.2 Use algebraic equations when appropriate.
7.2.5	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems. **Science**

	24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
7.3.6	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
8.1.1, 8.1.2	**English** 10.12.2 Negotiate to arrive at consensus by proposing and examining possible options. 10.12.3 Identify and practice techniques such as setting time limits for speakers and deadlines for decision making to improve productivity of group discussion.
8.2.2	**English** 10.12.1 Participate in problem-solving conversations or group discussions by identifying, synthesizing, and evaluating data.
8.3.6	**English** 4.12.6 Read and apply multi-step directions in order to perform complex procedures and tasks.
8.3.8	**English** 6.12.5 Edit for use of standard English. 7.12.1 Apply the rules of usage, grammar, and capitalization with few significant errors; use modifiers, parallel structure, and subordination correctly in writing. 7.12.3 Use rules of punctuation; manipulate conventions for emphasis in writing. 7.12.4 Use rules of capitalization. 7.12.5 Demonstrate conventional spelling.
8.8.1	**English** 6.12.5 Edit for use of standard English.
8.8.2	**English** 7.12.3 Use rules of punctuation; manipulate conventions for emphasis in writing.
8.8.3	**English** 5.12.5 Write summaries or abstracts that distill large amounts of information into clear, concise prose.

	7.12.4 Use rules of capitalization.
8.8.4	**<u>English</u>** 7.12.5 Demonstrate conventional spelling. 9.12.1 Use specific and varied vocabulary and apply standard English to communicate ideas.
8.8.5	**<u>English</u>** 7.12.1 Apply the rules of usage, grammar, and capitalization with few significant errors; use modifiers, parallel structure, and subordination correctly in writing.

STATE SKILL STANDARDS
WELDING

Career & Technical Education

Skills for Employment & Lifelong Learning

Prepared by:

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Adopted by the State Board of Education /
State Board for Occupational Education

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Introduction

The Department of Education has undertaken an ambitious effort to develop statewide occupational skill standards. The standards in this document are for welding programs and are designed to clearly state what the student should know and be able to do upon completion of an advanced high-school program.

The writing team determined that any statewide skill standards for programs that teach welding should be designed to teach entry-level and advanced skills related to the construction of a single-family residence. The standards cover the following areas: (1) Safety; (2) Measurement and Layout; (3) Metallurgy; (4) Tools and Machines; (5) Oxy-Fuel Welding/Cutting; (6) Shielded Metal Arc Welding; (7) Gas Metal Arc Welding; (8) Flux Core Arc Welding; (9) Gas Tungsten Arc Welding; (10) Plasma Arc Cutting; (11) Fabrication; (12) Weld Testing; (13) Employability Skills. The standards also include the math skills students need to be successful in the industry.

These exit-level standards are designed for advanced programs, for students completing the third level of a three- or four-year welding program. Students at the appropriate level of instruction will be expected to demonstrate competence for all performance indicators in the "meets standard" domains for each performance standard. Teachers are encouraged to use them for to focus curriculum objectives for entry-level programs, also.

The standards are organized as follows:

Content Standards are general statements that identify major areas of knowledge, understanding, and skills students are expected to learn in key subject and career areas by the end of the program.

Following each Content Standard are a number of **Performance Standards**. Performance Standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.

Each Performance Standard is analyzed into specific **Performance Indicators**. Performance Indicators are very specific criteria statements for determining whether a student exceeds the standard, meets the standard, or whose performance approaches the standard. Performance Indicators may also be used as learning outcomes which teachers can identify as they plan their program learning objectives.

Table of Contents

Content and Performance Standards
General Lab Safety

Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the welding lab.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 1.1	**The student will demonstrate adherence to general lab safety rules including but not limited to those listed in the following performance indicators.**
EXCEEDS STANDARDS	• Customize or develop a shop **safety** program. • Obtains certification in First Aid/CPR. • Model shop safety as a mentor to students.
MEETS STANDARDS	1.1.1 Pass safety test. 1.1.2 Identify and utilize proper storage for flammables. 1.1.3 Identify ventilation hazards and take corrective action. 1.1.4 Identify and report electrical hazards. 1.1.5 Demonstrate the ability to keep a clean, orderly, and safe work area. 1.1.6 Demonstrate safe use of personal protective equipment. 1.1.7 Demonstrate safe use of machines, tools, and equipment. 1.1.8 Portray safe behaviors/attitudes while in the working environment. 1.1.9 Explain proper steps in reporting an injury/accident or emergency. 1.1.10 Demonstrate proper lifting techniques. 1.1.11 Identify and use hearing protection when needed. 1.1.12 Explain the purpose of OSHA. 1.1.13 Demonstrate the safe handling of compressed gases under the direct supervision of the instructor.
APPROACHES STANDARD	• Read safety requirements found in the welding lab. • Identify safety procedures of machines, tools, and equipment. • Identify safe behaviors/attitudes. • List different types of hearing protection.

Nevada Academic Standards Correlation:
Science: 20.12.5, 24.12.1, 24.12.2, 24.12.3

Content and Performance Standards
General Lab Safety

Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the welding lab.

Performance Standard 1.2	**The student will demonstrate adherence to specific shop fire safety rules and procedures including but not limited to those listed in the following performance indicators.**
EXCEEDS STANDARDS	• Create a fire **safety** program.
MEETS STANDARDS	1.2.1 Describe the use of fire extinguishers and blankets. 1.2.2 Discuss the various types of fires for Class A, B, C, & D. 1.2.3 Demonstrate fire evacuation procedures. 1.2.4 Discuss and list potential fire hazards that exist in the welding lab. 1.2.5 Demonstrate use of ventilation system controls in the welding lab. 1.2.6 Recognize need and demonstrate use of personal respirators in the welding lab. 1.2.7 Demonstrate proper storage of flammable materials.
APPROACHES STANDARD	• Read fire **safety** requirements found in the welding lab. • Identify fire evacuation procedures. • Identify all locations of fire extinguishers, safety blankets, and exit routes.

Nevada Academic Standards Correlation:
Science: 24.12.1, 24.12.2

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the welding lab.**

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 2.1	**The student will use measuring tools to complete required lab assignments.**
EXCEEDS STANDARDS	• Demonstrate use of the metric measuring system as it applies to welding. • Demonstrate the use of fillet gages. • Model appropriate measuring techniques to peers.
MEETS STANDARDS	2.1.1 Demonstrate the use of semi-precision measuring devices to 1/64". 2.1.2 Demonstrate the use of precision measuring devices to include micrometers and Vernier calipers to 0.001".
APPROACHES STANDARD	• Identify semi-precision measuring devices. • Identify precision measuring devices.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the welding lab.

Performance Standard 2.2	**The student will be able to use and apply layout tools to complete required lab projects.**
EXCEEDS STANDARDS	• Layout advanced shapes and angles other than 45º and 90º. • Layout geometric shapes.
MEETS STANDARDS	2.2.1 Demonstrate use of a combination square set, dividers, scratch awls, layout fluid, soap stone, framing square, levels, trammel points and center punch. 2.2.2 Demonstrate use of bar and c-clamps, jigs and fixtures. 2.2.3 Demonstrate the use of layout equipment to the tolerance of 1/16” or 0.5º to complete assigned projects.
APPROACHES STANDARD	• Identify common layout tools. • Observe a video and/or demonstration on layout tools and techniques.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 3.12.5

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the welding lab.

Performance Standard 2.3	**The student will be able to interpret basic prints and develop a working drawing.**
EXCEEDS STANDARDS	• Draw orthographic projections with an isometric or oblique view. • Interpret blueprint abbreviations and symbols. • Draw plans complete with dimensions and proper symbols.
MEETS STANDARDS	2.3.1 Interpret basic welding symbols and prints. 2.3.2 Use orthographic projections to complete required assignments. 2.3.3 Develop a working drawing with a bill of materials.
APPROACHES STANDARD	• Differentiate between a working drawing and an orthographic projection. • Identify basic welding symbols.

Nevada Academic Standards Correlation:
Math: 1.12.1, 3.12.3

Content and Performance Standards
Measurement and Layout Techniques

Content Standard 2.0: Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the welding lab.

Performance Standard 2.4	**The student will be able to apply basic mathematical skills common to the welding industry.**
EXCEEDS STANDARDS	• Apply math solutions in the welding lab using geometry.
MEETS STANDARDS	2.4.1 Calculate math solutions using whole numbers, fractions, and decimals as they relate to welding projects. 2.4.2 Solve mathematical problems using handbooks, tables, charts, and graphs. 2.4.3 Identify units of measurement including lineal and volumetric. 2.4.4 Calculate the cost of materials.
APPROACHES STANDARD	• Identify whole numbers, fractions, and decimals. • Solve job related problems operating a handheld calculator.

Nevada Academic Standards Correlation:
Math: 1.12.1, 1.12.3, 3.12.3, 3.12.5

Content and Performance Standards
Metallurgy

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals common to the welding industry.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 3.1	**The student will identify metal types and shapes.**
EXCEEDS STANDARDS	• Demonstrate magnet and file test. • Analyze properties of metal alloys.
MEETS STANDARDS	3.1.1 Perform a spark test to determine ferrous from non-ferrous materials. 3.1.2 Identify metals such as steel, cast iron, aluminum, stainless steel, copper, brass, and zinc. 3.1.3 Define properties used to identify common metals (i.e. tensile strength, hardness, malleability, ductility). 3.1.4 List the five most common shapes of metal. 3.1.5 Identify thickness by using a wire gage.
APPROACHES STANDARD	• Describe metal making processes. • Observe a metal making process video.

Nevada Academic Standards Correlation:
Math: 3.12.2
Science: 2.12.1

Content and Performance Standards
Metallurgy

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals common to the welding industry.

Performance Standard 3.2	The student will describe the effects of heating, cooling, and annealing processes of metals to be fabricated.
EXCEEDS STANDARDS	• Demonstrate how metal is deformed during heating and cooling.
MEETS STANDARDS	3.3.1 Describe expansion and contraction as a result of heating and cooling metals. 3.3.2 Demonstrate **safe** methods of handling hot metals. 3.3.3 Demonstrate the annealing process. 3.3.4 Explain the need for pre-, intermediate-, and post-heating techniques.
APPROACHES STANDARD	• Recognize hot materials in the welding lab. • Explain the difference between tempering, hardening, and the annealing processes.

Nevada Academic Standards Correlation:
Science: 3.12.1, 24.12.1

Content and Performance Standards
Tools and Machines

Content Standard 4.0: Students will safely operate commonly used welding machines and tools.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 4.1	**The student will identify and safely operate stationary power machines commonly used in the welding industry.**
EXCEEDS STANDARDS	• Perform basic maintenance on machinery to comply with **safety** requirements.
MEETS STANDARDS	4.1.2 Demonstrate **safe** work practices for stationary power machines, including but not limited to: grinders, buffers, sanders, band saws, chop saws, shears, and presses.
APPROACHES STANDARD	• Identify basic stationary power machines such as grinders, buffers, sanders, band saws, chop saws, shears, and presses. • Identify **safety** features of basic stationary power machines such as grinders, buffers, sanders, band saws, chop saws, shears, and presses. • Observe **safety** video and demonstration.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Tools and Machines

Content Standard 4.0: Students will safely operate commonly used welding machines, and tools.

Performance Standard 4.2	**The student will identify and safely operate portable power machines commonly found in the welding industry.**
EXCEEDS STANDARDS	• Perform basic maintenance on portable power machines to comply with **safety** requirements.
MEETS STANDARDS	4.2.2 Demonstrate **safe** work practices for portable power machines, including but not limited to: grinders, buffers, sanders, band saws, shears, and drills.
APPROACHES STANDARD	• Identify basic portable power machines such as grinders, buffers, sanders, band saws, shears, and drills. • Identify **safety** features of basic portable power machines such as grinders, buffers, sanders, band saws, shears, and drills. • Observe a **safety** video and demonstration.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Tools and Machines

Content Standard 4.0: Students will safely operate commonly used metal working machines, and tools.

Performance Standard 4.3	**The student will identify and safely use hand tools commonly found in the welding industry.**
EXCEEDS STANDARDS	• Perform basic maintenance on chisels, punches, and related welding hand tools to comply with **safety** requirements.
MEETS STANDARDS	4.3.2 Demonstrate **safe** work practices for hand tools, including but not limited to: pliers, files, chisels, punches, hard face and soft face hammers, hacksaw, vises, and brushes.
APPROACHES STANDARD	• Identify basic hand tools such as pliers, files, chisels, punches, hard face and soft face, hammers, hacksaw, vises, and brushes. • Identify **safety** features of basic hand tools such as pliers, files, chisels, punches, hard face and soft face, hammers, hacksaw, vises, and brushes.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Oxy-Fuel Welding/Cutting

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 5.1	**The student will demonstrate use of proper personal protective equipment and procedures.**
EXCEEDS STANDARDS	• Clean and maintain personal protective **safety** gear. • Develop a personal **safety** checklist.
MEETS STANDARDS	5.1.5 Identify and list personal **safety** equipment in the welding lab. 5.1.6 Demonstrate appropriate use of personal **safety** equipment necessary to complete assigned projects. 5.1.7 Demonstrate the proper use of ventilation. 5.1.8 Demonstrate the proper use of personal respiration equipment.
APPROACHES STANDARD	• List personal protective **safety** equipment. • Observe a **safety** video and/or demonstration

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Oxy-Fuel Welding/Cutting

Content Standard 5.0: Students will identify, select, set-up, and demonstrate the use of oxy-fuel welding and cutting equipment.

Performance Standard 5.2	**The student will identify, select, set-up, and demonstrate the use of oxy-fuel welding equipment.**
EXCEEDS STANDARDS	• Demonstrate the ability to **safely** change cylinders used in oxy-fuel welding.
MEETS STANDARDS	5.2.1 Select and **safely** operate oxy-fuel welding equipment used to complete assigned projects. 5.2.2 Lay-out, cut, and fit materials (such as pipe, plate and structural shapes). 5.2.3 Identify types of fuel gasses and their application. 5.2.4 Identify, select, and set-up oxy-fuel welding equipment used to complete assigned projects. 5.2.5 Identify **safe** handling procedures of cylinders. 5.2.6 Demonstrate proper methods of cleaning and care of oxy-fuel welding equipment. 5.2.7 Select and exchange oxy-fuel welding attachments. 5.2.8 Identify, select, and use proper filler materials.
APPROACHES STANDARD	• List, identify and select oxy-fuel welding equipment. • Identify the various types of industrial gas cylinders. • Observe a video and/or demonstration.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 4.12.7
Science: 24.12.1

Content and Performance Standards
Oxy-Fuel Welding/Cutting

Content Standard 5.0: Students will identify, select, set-up, and demonstrate the use of oxy-fuel welding and cutting equipment.

Performance Standard 5.3	The student will identify, select, set-up, and demonstrate the use of oxy-fuel cutting equipment.
EXCEEDS STANDARDS	• Demonstrate piercing, slotting, and bevel cutting techniques. • Demonstrate the ability to **safely** change cylinders used in oxy-fuel cutting.
MEETS STANDARDS	5.3.1 Select and **safely** operate oxy-fuel cutting equipment used to complete assigned projects. 5.3.2 Lay-out, cut, and fit materials (such as pipe, plate, and structural shapes). 5.3.3 Identify types of fuel gasses and their application. 5.3.4 Identify, select, and set-up oxy-fuel cutting equipment used to complete assigned projects. 5.3.5 Identify **safe** handling procedures of cylinders. 5.3.6 Demonstrate proper methods of cleaning and care of oxy-fuel cutting equipment. 5.3.7 Select and exchange oxy-fuel cutting attachments.
APPROACHES STANDARD	• List, identify, and select oxy-fuel cutting equipment. • Identify the various types of industrial gas cylinders. • Observe a video and/or demonstration.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 4.12.7
Science: 24.12.1, 24.12.3

Content and Performance Standards
Oxy-Fuel Welding/Cutting

Content Standard 5.0: Students will identify, select, set-up, and demonstrate the use of oxy-fuel welding and cutting equipment.

Performance Standard 5.4	The student will identify, select, set-up, and demonstrate the use of oxy-fuel brazing techniques.
EXCEEDS STANDARDS	• Demonstrate the ability to **safely** change cylinders used in oxy-fuel brazing.
MEETS STANDARDS	5.4.1 Select and **safely** operate oxy-fuel brazing equipment to complete assigned projects. 5.4.2 Prepare materials properly for brazing. 5.4.3 Identify types of fuel gasses and their application. 5.4.4 Identify, select, and set-up oxy-fuel brazing equipment used to complete assigned projects. 5.4.5 Identify and select proper filler and flux materials. 5.4.6 Identify **safe** handling procedures of cylinders. 5.4.7 Demonstrate proper methods of cleaning and care of oxy-fuel brazing equipment. 5.4.8 Select and exchange oxy-fuel brazing attachments.
APPROACHES STANDARD	• List, identify, and select oxy-fuel brazing equipment. • Identify the various types of industrial gas cylinders. • Observe video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 24.12.1, 24.12.3

Content and Performance Standards
Shielded Metal Arc Welding

Content Standard 6.0: Students will identify, select, set-up, and demonstrate the use of Shielded Metal Arc Welding (SMAW) equipment.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 6.1	**The student will demonstrate safety procedures and describe the electrical theory of SMAW.**
EXCEEDS STANDARDS	• Model appropriate SMAW **safety** techniques to peers. • Identify SMAW **safety** problems, their causes, and take corrective action.
MEETS STANDARDS	6.1.1 Identify, list, and evaluate **safety** concerns common to the SMAW process. 6.1.2 Identify the different components of electricity and how they relate to the welding process. 6.1.3 Identify the polarities and currents used in SMAW. 6.1.4 Identify and explain the different types of power sources used. 6.1.5 Identify and report potential electrical **safety** hazards.
APPROACHES STANDARD	• List SMAW equipment. • Observe SMAW video and/or demonstration. • List five (5) SMAW **safety** concerns. • List personal safety gear required for SMAW.

Nevada Academic Standards Correlation:
Science: 1.12.5, 3.12.4, 24.12.1

Content and Performance Standards
Shielded Metal Arc Welding

Content Standard 6.0: Students will identify, select, set-up, and demonstrate the use of Shielded Metal Arc Welding (SMAW) equipment.

Performance Standard 6.2	**The student will be able to select and set-up the appropriate equipment and consumables used in SMAW.**
EXCEEDS STANDARDS	• Model appropriate SMAW techniques to peers. • Identify SMAW problems, their causes, and take corrective action.
MEETS STANDARDS	6.2.1 Identify, select, and set-up SMAW equipment. 6.2.2 Select appropriate electrodes to complete assignments. 6.2.3 Identify proper electrode storage. 6.2.4 Select appropriate polarity and current settings.
APPROACHES STANDARD	• List SMAW equipment. • Observe SMAW video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 3.12.4, 24.12.3

Content and Performance Standards
Shielded Metal Arc Welding

Content Standard 6.0: Students will identify, select, set-up, and demonstrate the use of Shielded Metal Arc Welding (SMAW) equipment.

Performance Standard 6.3	**The student will demonstrate SMAW using appropriate safety techniques.**
EXCEEDS STANDARDS	• Model appropriate SMAW techniques to peers. • Identify SMAW problems, their causes, and take corrective action. • Demonstrate the ability to weld in the overhead position.
MEETS STANDARDS	6.3.1 Select and **safely** operate SMAW equipment used to complete assigned projects. 6.3.2 Select appropriate electrodes to complete assignments. 6.3.3 Demonstrate proper selection and use of ventilation. 6.3.4 Demonstrate proper use of personal respiration. 6.3.5 Demonstrate proper cleaning and joint preparation. 6.3.6 Demonstrate striking an arc and running a bead. 6.3.7 Demonstrate the ability to weld in the flat, horizontal, and vertical positions to complete an assigned project.
APPROACHES STANDARD	• List SMAW equipment. • Observe SMAW video and/or demonstration. • List and draw the five (5) welding joints. • List the four (4) welding positions.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Gas Metal Arc Welding

Content Standard 7.0: Students will identify, select, set-up, and demonstrate the use of Gas Metal Arc Welding (GMAW) equipment.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 7.1	**The student will demonstrate safety procedures and describe the electrical theory of GMAW.**
EXCEEDS STANDARDS	• Model appropriate GMAW **safety** techniques to peers. • Identify GMAW **safety** problems, their causes, and take corrective action.
MEETS STANDARDS	7.1.1 Identify, list, and evaluate **safety** concerns common to the GMAW process. 7.1.2 Identify the different components of electricity and how they relate to the welding process. 7.1.3 Identify the polarities, wire feed speeds, and voltages used in GMAW. 7.1.4 Identify and explain the different types of power sources used. 7.1.5 Identify and report potential electrical **safety** hazards. 7.1.6 Differentiate between metal transfer methods.
APPROACHES STANDARD	• List GMAW equipment. • Observe GMAW video and/or demonstration. • List five (5) GMAW safety concerns. • List personal **safety** gear required for GMAW.

Nevada Academic Standards Correlation:
Science: 1.12.5, 3.12.4, 24.12.1

Content and Performance Standards
Gas Metal Arc Welding

Content Standard 7.0: Students will identify, select, set-up, and demonstrate the use of Gas Metal Arc Welding (GMAW) equipment.

Performance Standard 7.2	The student will be able to select and set-up the appropriate equipment and consumables used in GMAW.
EXCEEDS STANDARDS	• Model appropriate GMAW techniques to peers. • Identify GMAW problems, their causes, and take corrective action.
MEETS STANDARDS	7.2.1 Identify, select, and set-up GMAW equipment. 7.2.2 Select appropriate wire, size, and type to complete assignments. 7.2.3 Select appropriate voltage and wire feed speed settings to complete assignment. 7.2.4 Demonstrate proper maintenance for wire delivery systems. 7.2.5 Select appropriate gas and flow rate to complete assignment.
APPROACHES STANDARD	• List GMAW equipment. • Observe GMAW video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 24.12.3

Content and Performance Standards
Gas Metal Arc Welding

Content Standard 7.0: **Students will identify, select, set-up, and demonstrate the use of Gas Metal Arc Welding (GMAW) equipment.**

Performance Standard 7.3	**The student will demonstrate GMAW using appropriate safety techniques.**
EXCEEDS STANDARDS	• Model appropriate GMAW techniques to peers. • Identify GMAW problems, their causes, and take corrective action. • Demonstrate the ability to weld in the overhead position.
MEETS STANDARDS	7.3.1 Select and **safely** operate GMAW equipment used to complete assigned projects. 7.3.2 Select appropriate wire to complete assignments. 7.3.3 Demonstrate proper selection and use of ventilation. 7.3.4 Demonstrate proper use of personal respiration. 7.3.5 Demonstrate proper cleaning and joint preparation. 7.3.6 Demonstrate starting an arc and running a bead. 7.3.7 Demonstrate the ability to weld in the flat, horizontal, and vertical positions to complete an assigned project.
APPROACHES STANDARD	• List GMAW equipment. • Observe GMAW video and/or demonstration. • List and draw the five (5) welding joints. • List the four (4) welding positions.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Flux Core Arc Welding

Content Standard 8.0: Students will identify, select, set-up, and demonstrate the use of Flux Core Arc Welding (FCAW) equipment.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 8.1	**The student will demonstrate safety procedures and describe the electrical theory of FCAW.**
EXCEEDS STANDARDS	• Model appropriate FCAW **safety** techniques to peers. • Identify FCAW **safety** problems, their causes, and take corrective action.
MEETS STANDARDS	8.1.1 Identify, list and evaluate **safety** concerns common to the FCAW process. 8.1.2 Identify the different components of electricity and how they relate to the FCAW process. 8.1.3 Identify the polarities and currents used in FCAW. 8.1.4 Identify and explain the different types of power sources used. 8.1.5 Identify and report potential electrical **safety** hazards.
APPROACHES STANDARD	• List FCAW equipment. • Observe FCAW video and/or demonstration. • List five (5) FCAW safety concerns. • List personal **safety** gear required for FCAW.

Nevada Academic Standards Correlation:
Science: 1.12.5, 3.12.4, 24.12.1

Content and Performance Standards
Flux Core Arc Welding

Content Standard 8.0: Students will identify, select, set-up, and demonstrate the use of Flux Core Arc Welding (FCAW) equipment.

Performance Standard 8.2	The student will be able to select and set-up the appropriate equipment and consumables used in FCAW.
EXCEEDS STANDARDS	• Model appropriate FCAW techniques to peers. • Identify FCAW problems, their causes, and take corrective action. • Select appropriate gasses for dual shield FCAW.
MEETS STANDARDS	8.2.1 Identify, select, and **safely** set-up FCAW equipment. 8.2.2 Select appropriate polarity and current settings. 8.2.3 Select appropriate wire, size and type, to complete assignments. 8.2.4 Select appropriate voltage and wire feed speed settings. 8.2.5 Demonstrate proper maintenance for wire delivery systems.
APPROACHES STANDARD	• List FCAW equipment. • Observe FCAW video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 3.12.4, 24.12.1, 24.12.3

Content and Performance Standards
Flux Core Arc Welding

Content Standard 8.0: Students will identify, select, set-up, and demonstrate the use of Flux Core Arc Welding (FCAW) equipment.

Performance Standard 8.3	**The student will demonstrate FCAW using appropriate safety techniques.**
EXCEEDS STANDARDS	• Model appropriate FCAW techniques to peers. • Identify FCAW problems, their causes, and take corrective action. • Demonstrate the ability to weld in the overhead position.
MEETS STANDARDS	8.3.1 Select and **safely** operate FCAW equipment used to complete assigned projects. 8.3.2 Demonstrate proper selection and use of ventilation. 8.3.3 Demonstrate proper use of personal respiration. 8.3.4 Demonstrate proper cleaning and joint preparation. 8.3.5 Demonstrate starting an arc and running a bead. 8.3.6 Demonstrate the ability to weld in the flat, horizontal, and vertical positions to complete an assigned project.
APPROACHES STANDARD	• List FCAW equipment. • Observe FCAW video and/or demonstration. • List and draw the five (5) welding joints. • List the four (4) welding positions.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Gas Tungsten Arc Welding

Content Standard 9.0: **Students will identify, select, set-up, and demonstrate the use of Gas Tungsten Arc Welding (GTAW) equipment.**

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 9.1	**The student will demonstrate safety procedures and describe the electrical theory of GTAW.**
EXCEEDS STANDARDS	• Model appropriate GTAW **safety** techniques to peers. • Identify GTAW **safety** problems, their causes, and take corrective action.
MEETS STANDARDS	9.1.1 Identify, list, and evaluate **safety** concerns common to the GTAW process. 9.1.2 Identify the different components of electricity and how they relate to the GTAW process. 9.1.3 Identify the polarities, currents, and modes of high frequencies used in GTAW. 9.1.4 Identify and explain the different types of power sources used. 9.1.5 Identify and report potential electrical **safety** hazards.
APPROACHES STANDARD	• List GTAW equipment. • Observe GTAW video and/or demonstration. • List five (5) GTAW safety concerns. • List personal **safety** gear required for GTAW.

Nevada Academic Standards Correlation:
Science: 1.12.5, 3.12.4, 24.12.1, 24.12.3

Content and Performance Standards
Gas Tungsten Arc Welding

Content Standard 9.0: Students will identify, select, set-up, and demonstrate the use of Gas Tungsten Arc Welding (GTAW) equipment.

Performance Standard 9.2	**The student will be able to select and set-up the appropriate equipment and consumables used in GTAW.**
EXCEEDS STANDARDS	• Model appropriate GTAW techniques to peers. • Identify GTAW problems, their causes, and take corrective action.
MEETS STANDARDS	9.2.1 Identify, select, and **safely** set-up GTAW equipment. 9.2.2 Select appropriate electrodes to complete assignments. 9.2.3 Identify proper electrode preparation. 9.2.4 Select appropriate polarity and current settings. 9.2.5 Select appropriate filler material, size and type, to complete assignments. 9.2.6 Select appropriate current and high frequency mode. 9.2.7 Select appropriate gas, flow rate, and post flow.
APPROACHES STANDARD	• List GTAW equipment. • Observe GTAW video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 3.12.4, 24.12.1, 24.12.3

Content and Performance Standards
Gas Tungsten Arc Welding

Content Standard 9.0: Students will identify, select, set-up, and demonstrate the use of Gas Tungsten Arc Welding (GTAW) equipment.

Performance Standard 9.3	The student will demonstrate GTAW using appropriate safety techniques.
EXCEEDS STANDARDS	• Model appropriate GTAW techniques to peers. • Identify GTAW problems, their causes, and take corrective action. • Demonstrate the ability to weld in the overhead position.
MEETS STANDARDS	9.3.1 Select and **safely** operate GTAW equipment used to complete assigned projects. 9.3.2 Demonstrate proper selection and use of ventilation. 9.3.3 Demonstrate proper use of personal respiration. 9.3.4 Demonstrate proper cleaning and joint preparation. 9.3.5 Demonstrate starting an arc and running a bead. 9.3.6 Demonstrate the ability to weld in the flat, horizontal, and vertical positions to complete an assigned project.
APPROACHES STANDARD	• List GTAW equipment. • Observe GTAW video and/or demonstration. • List and draw the five (5) welding joints. • List the four (4) welding positions.

Nevada Academic Standards Correlation:
Science: 24.12.1

Content and Performance Standards
Plasma Arc Cutting

Content Standard 10.0: **Students will identify, select, set-up, and demonstrate the use of Plasma Arc Cutting equipment.**

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 10.1	**The student will demonstrate safety procedures and describe the electrical theory of Plasma Arc Cutting.**
EXCEEDS STANDARDS	• Model appropriate Plasma Arc Cutting **safety** techniques to peers. • Identify Plasma Arc Cutting **safety** problems, their causes, and take corrective action.
MEETS STANDARDS	10.1.1 Identify, list, and evaluate **safety** concerns common to the Plasma Arc Cutting process. 10.1.2 Identify the different components of plasma and how they relate to the Plasma Arc Cutting process. 10.1.3 Identify and explain the type of power source used. 10.1.4 Identify and report potential electrical **safety** hazards.
APPROACHES STANDARD	• List Plasma Arc Cutting equipment. • Observe Plasma Arc Cutting video and/or demonstration. • List five (5) Plasma Arc Cutting safety concerns. • List personal **safety** gear required for Plasma Arc Cutting.

Nevada Academic Standards Correlation:
Science: 1.12.5, 24.12.1

Content and Performance Standards
Plasma Arc Cutting

Content Standard 10.0: Students will identify, select, set-up, and demonstrate the use of Plasma Arc Cutting equipment.

Performance Standard 10.2	The student will be able to select and set-up the appropriate equipment and consumables used in Plasma Arc Cutting.
EXCEEDS STANDARDS	• Model appropriate Plasma Arc Cutting techniques to peers. • Identify Plasma Arc Cutting problems, their causes, and take corrective action.
MEETS STANDARDS	10.2.1 Identify, select, and **safely** set-up Plasma Arc Cutting equipment. 10.2.2 Select appropriate nozzles and current setting to complete assignments. 10.2.3 Identify proper sequence for assembling Plasma torch components. 10.2.4 Select appropriate flow rate for compressed air.
APPROACHES STANDARD	• List Plasma Arc Cutting equipment. • Observe Plasma Arc Cutting video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 24.12.1, 24.12.3

Content and Performance Standards
Plasma Arc Cutting

Content Standard 10.0: Students will identify, select, set-up, and demonstrate the use of Plasma Arc Cutting equipment.

Performance Standard 10.3	The student will set-up and demonstrate Plasma Arc Cutting techniques.
EXCEEDS STANDARDS	• Model appropriate Plasma Arc Cutting techniques to peers. • Identify Plasma Arc Cutting problems, their causes, and take corrective action.
MEETS STANDARDS	10.3.1 Select and **safely** operate Plasma Arc Cutting equipment used to complete assigned projects. 10.3.2 Select appropriate nozzles and air pressure to complete assignments. 10.3.3 Demonstrate proper selection and use of ventilation. 10.3.4 Demonstrate proper use of personal respiration.
APPROACHES STANDARD	• List Plasma Arc Cutting equipment. • Observe Plasma Arc Cutting video and/or demonstration.

Nevada Academic Standards Correlation:
Science: 24.12.1, 24.12.3

Content and Performance Standards
Fabrication

Content Standard 11.0: **Students will identify tools, equipment, and demonstrate fabrication techniques.**

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 11.1	**The student will identify and demonstrate the use of fabrication techniques and equipment while planning, designing, laying-out, and constructing projects.**
EXCEEDS STANDARDS	• Perform weldments in the proper sequence.
MEETS STANDARDS	11.1.1 Demonstrate the ability to construct projects in a proper sequence. 11.1.2 Demonstrate the ability to tack metal together to specification. 11.1.3 Demonstrate the ability to layout projects to blue prints. 11.1.4 Demonstrate the ability to cut miter joints to specific angles. 11.1.5 Demonstrate the ability to check work for accuracy. 11.1.6 Demonstrate the ability to **safely** use tools, including but not limited to: band saws, chop saws, grinders, drills, torches, and clamping devices. 11.1.7 Demonstrate **safe** handling of long and/or heavy objects. 11.1.8 Demonstrate the ability to de-burr sharp edges.
APPROACHES STANDARD	• List the steps to assure accurate layout. • List steps to layout miter cuts. • Compute miter cut angles.

Nevada Academic Standards Correlation:
Math: 3.12.2, 3.12.3, 3.12.5
Science: 24.12.1

Content and Performance Standards
Weld Testing

Content Standard 12.0: Students will identify defects and take corrective action based on non-destructive and destructive weld testing.

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

Performance Standard 12.1	**The student will identify and perform non-destructive weld testing techniques.**
EXCEEDS STANDARDS	• Identify defects and take corrective action on the non-destructive test.
MEETS STANDARDS	12.1.1 Prepare a sample for a non-destructive test. 12.1.2 Inspect for undercutting, overlap, porosity, slag, spatter, and surface cracks. 12.1.3 Identify and list several of the non-destructive examination processes.
APPROACHES STANDARD	• List the non-destructive weld defects

Content and Performance Standards
Weld Testing

Content Standard 12.0: Students will identify defects and take corrective action based on non-destructive and destructive weld testing.

Performance Standard 12.2	The student will identify and perform destructive weld testing techniques.
EXCEEDS STANDARDS	• Determine weld defects and take corrective action based on destructive test.
MEETS STANDARDS	12.2.1 Prepare a coupon for destructive test. 12.2.2 Perform a destructive test on weld coupon.
APPROACHES STANDARD	• List destructive weld defects.

Content and Performance Standards
Employability Skills

Content Standard 13.0*:* Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 13.1	The student will demonstrate problem-solving skills.
EXCEEDS STANDARD	• Develop methods to analyze the advantages and disadvantages of alternative solutions. • Devise an action plan for a welding problem based on information gained through research of alternative solutions and implement in a group decision/action.
MEETS STANDARD	8.1.6 Solve a welding problem using the appropriate steps in the problem-solving process. 8.1.7 Demonstrate brainstorming techniques. 8.1.8 Examine and explain the advantages and disadvantages of alternative solutions to one or more problems. 8.1.9 Create an action plan based upon a solution to a welding problem. 8.1.10 Identify the benefits of solving a welding problem.
APPROACHES STANDARD	• Identify the basic steps in the problem-solving process. • Identify alternative solutions to a problem. • Identify the basic components of an action plan.

Nevada Academic Standards Correlation:
English: 10.12.2, 10.12.3

Content and Performance Standards
Employability Skills

Content Standard 13.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 13.2 The student will demonstrate critical-thinking skills.	
EXCEEDS STANDARD	• Analyze how critical thinking skills affect work performance. • Formulate, implement, and evaluate an action plan. • Demonstrate the skills necessary to identify, analyze, and solve a design problem.
MEETS STANDARD	8.2.6 Identify and explains the essential elements of the critical thinking process as related to the welding trades. 8.2.7 Demonstrate critical thinking skills necessary in the welding trades. 8.2.8 Explain how emotional thinking and logical thinking affect decision making in the welding trades. 8.2.9 Explain the difference between reliable and unreliable observations and statements of facts. 8.2.10 Recognize patterns or relationships through observation and discovery.
APPROACHES STANDARD	• State the importance of critical thinking in identifying, analyzing, and solving a welding problem. • Identify the essential steps of critical thinking. • Define emotional and logical thinking • Identify the difference between opinions and statements of fact.

Nevada Academic Standards Correlation:
English: 10.12.1

Content and Performance Standards
Employability Skills

Content Standard 13.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 13.3	The student will demonstrate the ability to speak, write, and listen effectively.
EXCEEDS STANDARD	• Identify research, prepare and deliver a welding related presentation. • Prepare technical documents relating to bill of materials, blueprints, etc. • Present and defend a welding procedure. • Compete in a SkillsUSA job skill demonstration and/or public speaking contest
MEETS STANDARD	• Explain the benefits of effective communication skills in the workplace. • Effectively interpret and responds to verbal and nonverbal messages. • Demonstrate proper telephone etiquette. • Effectively communicates thoughts, ideas and information in writing. • Organize ideas and communicate orally; is able to effectively demonstrate job skills to others. • Locate, understand and interpret written information in documents such as manuals, graphs and schedules. • Select and utilize an appropriate medium for conveying messages with dignity and respect. • Organize information into the appropriate format in accordance with standard practices, which includes prewriting, drafting, proofreading, editing/revising, and preparing final copy. • Demonstrate sensitivity to cultural diversity in communication. • Identify common communication barriers and methods for improving communication.

APPROACHES STANDARD	• Define communications. • Explain the benefits of effective communication in the welding trade. • Explain how cultural and physical diversity effect communication. • Identify applicable medium for conveying messages.

Nevada Academic Standards Correlation:
English: 4.12.6, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5

Content and Performance Standards
Employability Skills

Content Standard 13.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 8.4	The student will demonstrate the ability to select, apply, and maintain appropriate technology.
EXCEEDS STANDARD	• Critique the use, benefits and cost of technologically advanced equipment in the welding trade. • Analyze the impact of technological changes on one or more aspects of welding trades by researching current literature. • Compete in a state-level SkillsUSA welding contest.
MEETS STANDARD	8.4.8. Demonstrate ability to utilize basic keyboarding techniques. 8.4.9. Demonstrate ability to utilize other input devices. 8.4.10. Demonstrate ability to utilize various electronic research methods. 8.4.11. Demonstrate knowledge of the basic technology systems currently available and how they apply to your field (i.e. word processing, spreadsheets, multimedia applications and databases). 8.4.12. Investigate and explain the use, benefits, and costs of technological developments in the workplace and school. 8.4.13. Identify and demonstrate the appropriate use of technology to enhance the efficiency of the workplace and school. 8.4.14. Demonstrate routine maintenance and repair of technological equipment.
APPROACHES STANDARD	• Recognize technology used in the welding trade. • Use an Internet browser to locate specific Websites related to welding trades.

Nevada Academic Standards Correlation:
Math: 3.12.4

Content and Performance Standards
Employability Skills

Content Standard 13.0: **Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

Performance Standard 13.5	The student will demonstrate leadership and teamwork skills.
EXCEEDS STANDARD	• Analyze the stages of group development. • Demonstrate leadership ability within a group or team. • Compromise and/or build consensus within a group and summarize the decision of the group while maintaining respect for diverse viewpoints. • Complete levels 1-3 of the SkillsUSA Professional Development Program. • Campaign for a local SkillsUSA chapter office. • Serve as a committee chair in a local SkillsUSA chapter.
MEETS STANDARD	8.5.8. Work cooperatively with others when given group project. 8.5.9. Explain traits necessary to effectively lead and influence individuals and groups. 8.5.10. Demonstrate appropriate attitudes and behaviors for effective leadership. 8.5.11. Demonstrate respect for team members, team processes, and team goals. 8.5.12. Participate in the implementation of a group's decision and evaluates the results. 8.5.13. Demonstrate the qualities of an effective leader and team member. 8.5.14. Describe the importance of a proper dress code.
APPROACHES STANDARD	• Explain the importance of groups. • Explain how to organize groups. • Wear appropriate attire.

Content and Performance Standards
Employability Skills

Content Standard 13.0: **Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

Performance Standard 13.6	The student will demonstrate sound workplace ethics.
EXCEEDS STANDARD	• Demonstrate time-management skills and cost-effective practices.
MEETS STANDARD	13.6.1 Develop personal work ethics through work experience. 13.6.2 Describe the importance of ethics practiced in the workplace. 13.6.3 Demonstrate regular attendance, promptness, and the willingness to follow instructions and complete an assigned task. 13.6.4 Demonstrate appropriate personal and professional attitudes and behaviors. 13.6.5 Maintain a safe, clean, and organized work area. 13.6.6 Demonstrate awareness of legal responsibilities related to individual performance, safety, and customer satisfaction. 13.6.7 Demonstrate knowledge of various types of harassment.
APPROACHES STANDARD	• List the important ethics in the workplace. • Meet attendance standards. • Describe an organized workplace. • Identify appropriate responses to unethical actions.

Content and Performance Standards
Employability Skills

Content Standard 13.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 13.7	The student will demonstrate the ability to effectively manage resources in high-performance workplaces.
EXCEEDS STANDARD	• Recognize the individual roles of team members, delegate tasks, and provide feedback on performance. • Acknowledge and utilize the skills, abilities, and input of all members of a team. • Develop an action plan to accomplish tasks within a given time frame.
MEETS STANDARD	13.7.1 Develop a time schedule and prioritized task list to complete a job assignment. 13.7.2 Identify the resources needed to complete a job assignment. 13.7.3 Organize the material resources and space requirements needed to complete a job assignment. 13.7.4 Effectively use technology to complete a job assignment. 13.7.5 Demonstrate cooperation and leadership as a team at school or in a workplace setting. 13.7.6 Use the basic components of effective time management. 13.7.7 Recognize the need for management skills in the workplace with regard to stress, anger management, and substance abuse
APPROACHES STANDARD	• List effective time management skills. • Use technology to complete assignments. • Utilize materials, tools, and processes to complete a task related to a career selection. • Read and follow instructions from manuals on the use and care of materials, tools, and equipment. • Maintain a clean, organized, and **safe** job site. • Identify traits needed for cooperation and leadership in a team at school or in a workplace setting. • Identify the material resources and space requirements needed to complete an assignment.

Content and Performance Standards
Employability Skills

Content Standard 13.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Standard 13.8	The student will demonstrate career planning and development skills.
EXCEEDS STANDARD	• Develop a community service or job shadowing project. • Develop an education/training plan to fulfill long-term career goals. • Define advantages and disadvantages of self-employment or working for various sizes and types of businesses. • Critique results of a job interview. • Develop a proposal for an organized community service project. • Compete in a state level SkillsUSA job interview contest.
MEETS STANDARD	13.8.1 Prepare a job application. 13.8.2 Prepare a personal resume. 13.8.3 Complete a personal aptitude and interest inventory. 13.8.4 Participate in a mock job interview. 13.8.5 Establish short-term career goals. 13.8.6 Establish long-term career goals. 13.8.7 Use the Nevada Career Information System (CIS) or a similar computer-based program to research careers in a chosen field. 13.8.8 Participates in an organized job-shadowing activity. 13.8.9 Participate in a community service project. 13.8.10 Construct a career portfolio.
APPROACHES STANDARD	• Locate employment opportunities. • Identify job requirements for entry-level positions in the welding industry. • Identify general conditions for employment. • Identify educational/training requirements for related welding fields. • Identify the elements of goal setting. • Identify welding related careers. • Describe essential job interview skills. • Identify the components of a career portfolio.

Nevada Academic Standards Correlation:
English: 5.12.5, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5, 9.12.1

Content and Performance Standards
Employability Skills

Content Standard 13.0: **Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

Performance Standard 13.9	The student will demonstrate job-retention and lifelong-learning skills.
EXCEEDS STANDARD	• Maintain an electronic portfolio. • Create a plan for lifelong learning. • Create a presentation illustrating interpersonal skills needed for job retention. • Adapt new knowledge and skills in changing situations. • Analyze how work life is affected by families and how families are affected by work life.
MEETS STANDARD	8.9.9. Maintain an employment/career portfolio. 8.9.10. Explain strategies for balancing work and family roles. 8.9.11. Demonstrate understanding of the need for lifelong learning in a rapidly changing job market. 8.9.12. Describe strategies to maintain employment in the face of job reductions. 8.9.13. Develop long-term career planning strategies. 8.9.14. Describe various educational options needed for job retention. 8.9.15. Model sound workplace ethics, such as loyalty, punctuality, and initiative. 8.9.16. Demonstrates interpersonal skills needed for job retention.
APPROACHES STANDARD	• Describe the importance of a portfolio. • Identify options for lifelong learning. • Identify interpersonal skills needed for job retention. • Identify jobs with opportunity for advancement. • Describe the importance of career planning.

CROSSWALK OF WELDING STANDARDS AND ACADEMIC STANDARDS

Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the welding lab.

Performance Indicators	Academic Standards
1.1.2	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards. 24.12.2 Use the information found in materials safety data sheets to handle, store, and dispose of chemicals properly.
1.1.3, 1.1.4	**Science** 20.12.5 Identify the type of hazard, estimate the extent and consequences of exposure, and determine the options for reducing or eliminating risks.
1.1.5, 1.1.6, 1.1.7, 1.1.8. 1.1.9, 1.1.10. 1.1.11	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
1.2.1 - 1.2.6	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
1.2.7	**Science** 24.12.2 Use the information found in materials safety data sheets to handle, store, and dispose of chemicals properly.

Content Standard 2.0: Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.

2.1.1, 2.1.2	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.

2.2.1, 2.2.3	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations**.**
2.3.1	**Math** 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences among accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.
2.3.3	**Math** 1.12.1 **Calculate** and estimate sums, differences, products, quotients, **powers,** and **roots** using mental math, **formulas**, and **algorithms**.
2.4.1, 2.4.2	**Math** 1.12.1 **Calculate** and estimate sums, differences, products, quotients, **powers,** and **roots** using mental math, **formulas**, and **algorithms**. 1.12.3 Apply the properties and theories of the real number system to everyday situations.
2.4.3	**Math** 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences among accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.
2.4.4	**Math** 1.12.1 **Calculate** and estimate sums, differences, products, quotients, **powers,** and **roots** using mental math, **formulas**, and **algorithms**.

Content Standard 3.0: Students will identify the classification and physical properties of different types of metals.

3.1.1, 3.1.2, 3.1.3, 3.1.4	**Science** 2.12.1 Investigate and describe **intrinsic** (color, odor, density) and **extrinsic** (e.g., size, mass, volume) physical properties of matter.
3.1.5	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.
3.2.1	**Science** 3.12.1 Explain that the transformation of energy usually results in some energy in the form of heat, which spreads by radiation, conduction, and sometimes convection into cooler places.
3.2.2, 3.2.3	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
3.2.4	**Science** 3.12.1 Explain that the transformation of energy usually results in some energy in the form of heat, which spreads by radiation, conduction, and sometimes convection into cooler places

Content Standard 4.0: Students will safely operate commonly used welding machines, and tools.

4.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
4.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
4.3.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

5.1.1, 5.1.2, 5.13, 5.1.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.2	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 4.12.7 Apply the Pythagorean Theorem, its **converse**, properties of special right triangles, and right triangle trigonometry to solve practical problems.
5.2.3, 5.2.4, 5.2.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.6	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment.
5.3.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.3.2	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.

	4.12.7 Apply the Pythagorean Theorem, its **converse**, properties of special right triangles, and right triangle trigonometry to solve practical problems.
5.3.4, 5.3.4, 5.3.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.3.6	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment.
5.3.6, 5.3.7	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.4.1	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment.
5.4.3, 5.4.4, 5.4.6	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.4.7, 5.4.8	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment.

Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.

6.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
6.1.2, 6.1.3	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
6.1.4	**Science** 1.12.5 Investigate and explain that magnetic forces are related to electric forces and can be thought of as different aspects of a single electromagnetic force. (e.g., electric motors, generators, radios).

6.1.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
6.2.1	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment
6.2.4	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
6.3.1, 6.3.3, 6.3.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metals lab.

7.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards
7.1.2, 7.1.3,	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
7.1.4	**Science** 1.12.5 Investigate and explain that magnetic forces are related to electric forces and can be thought of as different aspects of a single electromagnetic force. (e.g., electric motors, generators, radios).
7.1.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
7.2.1	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment
7.3.1, 7.3.3, 7.3.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 8.0: Students will identify and safely operate machine tools commonly used in the metals lab.

8.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
8.1.2, 8.1.3	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
8.1.4	**Science** 1.12.5 Investigate and explain that magnetic forces are related to electric forces and can be thought of as different aspects of a single electromagnetic force. (e.g., electric motors, generators, radios).
8.1.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
8.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
8.2.2, 8.2.4	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
8.2.5	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment
8.3.1, 8.3.2, 8.3.3	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 9.0: Students will identify, select, set-up, and demonstrate the use of Gas Tungsten Arc Welding (GTAW) equipment.

9.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

9.1.2, 9.1.3	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
9.1.4	**Science** 1.12.5 Investigate and explain that magnetic forces are related to electric forces and can be thought of as different aspects of a single electromagnetic force. (e.g., electric motors, generators, radios).
9.1.5	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
9.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
9.2.4, 9.2.6	**Science** 3.12.4 Describe the properties of electrical circuits in terms of moving electrons, conductivity, resistance, and electrical potential energy.
9.2.7	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical, and scientific equipment
9.3.1, 9.3.2, 9.3.3	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 10.0: Students will identify, select, set-up, and demonstrate the use of Plasma Arc Cutting equipment.

10.1.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
10.1.3	**Science** 1.12.5 Investigate and explain that magnetic forces are related to electric forces and can be thought of as different aspects of a single electromagnetic force. (e.g., electric motors, generators, radios).

10.1.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
10.2.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
10.2.2, 10.2.3, 10.2.4	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment
10.3.1	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
10.3.2, 10.3.3	**Science** 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment
10.3.4	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 11.0: Students will identify tools, equipment, and demonstrate fabrication techniques.

11.1.3, 11.1.4, 11.1.5	**Math** 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distance, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences among accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.
11.1.6, 11.1.7	**Science** 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 13.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

13.1.1, 13.2	**English** 10.12.2 Negotiate to arrive at consensus by proposing and examining possible options. 10.12.3 Identify and practice techniques such as setting time limits for speakers and deadlines for decision making to improve productivity of group discussion.
13.2.2	**English** 10.12.1 Participate in problem-solving conversations or group discussions by identifying, synthesizing, and evaluating data.
13.3.6	**English** 4.12.6 Read and apply multi-step directions in order to perform complex procedures and tasks.
13.3.8	**English** 6.12.5 Edit for use of standard English. 7.12.1 Apply the rules of usage, grammar, and capitalization with few significant errors; use modifiers, parallel structure, and subordination correctly in writing. 7.12.3 Use rules of punctuation; manipulate conventions for emphasis in writing. 7.12.4 Use rules of capitalization. 7.12.5 Demonstrate conventional spelling.
13.8.1	**English** 6.12.5 Edit for use of standard English.
13.8.2	**English** 7.12.3 Use rules of punctuation; manipulate conventions for emphasis in writing. 7.12.5 Demonstrate conventional spelling. 9.12.1 Use specific and varied vocabulary and apply standard English to communicate ideas.
13.8.3	**English** 5.12.5 Write summaries or abstracts that distill large amounts of information into clear, concise prose. 7.12.4 Use rules of capitalization.
13.8.4	**English** 7.12.5 Demonstrate conventional spelling. 9.12.1 Use specific and varied vocabulary and apply standard English to communicate ideas.
13.8.5, 13.8.6	**English** 7.12.3 Use rules of punctuation; manipulate conventions for

	emphasis in writing. 7.12.5 Demonstrate conventional spelling. 9.12.1 Use specific and varied vocabulary and apply standard English to communicate ideas.

NOTICE OF ADOPTION OF TEMPORARY REGULATION
LCB File No. T039-05

The State Board of Education adopted temporary regulations assigned LCB File No. T039-05 which pertain to chapter 389 of the Nevada Administrative Code on March 19,2005.

Notice date: 2/11/2005 **Date of adoption by agency:** 3/19/2005
Hearing date: 3/19/2005 **Filing date:** 5/18/2005

INFORMATIONAL STATEMENT

1. A description of how public comment was solicited, a summary of public response, and explanation how other interested persons may obtain a copy of the summary.

Notice of Workshop to Solicit Comments on Proposed Regulations was sent to approximately 150 individuals and educational organizations. One workshop was held on March 19, 2005. There were no comments from the public.

The Notice of Intent to Act Upon a Regulation for public hearing and adoption of the proposed revisions to NRS 233b & Administrative Rulemaking Procedural Guide, NAC 389 Metalworking (NRS 385.080, 385.110); NAC 389.612 Welding (NRS 385.080, 385.110), was sent to approximately 150 individuals and educational organizations. The public hearing was conducted on March 19, 2005, to provide the opportunity for comments by affected parties and the public. There were no comments from the public. The Board adopted the proposed regulation.

2. The Number of Persons Who:

a) Attended Each Hearing: Workshop: 15 Regular meeting: 16
b) Testified at Each Hearing; Workshop: 4 Regular meeting: 0
c) Submitted Written Statements: Workshop: 0 Regular meeting: 0

A copy of any written comments may be obtained by contacting Nita Barnes, Administrative Assistant to the Nevada State Board of Education, at the Department of Education (775) 687-9225, or by writing to the Department of Education at 700 East Fifth Street, Carson City, Nevada 89701-5096.

3. A description of how comment was solicited from affected businesses, a summary of the response and an explanation how other interested parties may obtain a copy of the summary.

Comments were solicited through the workshop notice of February 11, 2005, and the public hearing notice of February 11, 2005. At the March 19, 2005 Workshop to Solicit Comments there were no public comments to the proposed language revisions. At the March 19, 2005 Public Hearing there were no public comments to the proposed language.

Phyllis Dryden, Director of Career, Technical and Adult Education, and Mike Raponi, Consultant for Career and Technical, explained these revisions would replace the standards developed in the 1980's. The revisions reflect national skills standards for Nevada students to compete nationally.

Mike Pointer, writing team facilitator from the Regional Technical Institute of Reno, was available for questions.

Dr. Dottie Merrill, Assistant Superintendent, Washoe County School District, testified on behalf of Janet Hay, Coordinator for Career Technical Education for Washoe County, requesting full support for the revised standards.

A copy of the summary and/or minutes of the public hearing may be obtained by contacting Nita Barnes, Administrative Assistant to the Nevada State Board of Education, Nevada Department of Education, 775-687-9225, or by writing to the Nevada Department of Education at 700 East Fifth Street, Carson City, Nevada 89701-5096.

4. If the regulation was adopted with or without change to any part of the proposed regulation, a summary of the reasons for adopting.

The Nevada State Board of Education adopted the proposed regulation language at the public hearing held March 19, 2005. The reason for adopting the new occupational skill standards for Metalworking and Welding programs is the need to replace portions of the occupational courses of study in the Nevada Administrative Code that were developed during the 1980's. The new skill standards were adapted from national industry skill standards and other states' standards. The standards have also been endorsed by local business and industry.

5. The estimated economic effect of the adopted regulation on the business which it is to regulate and on the public. These must be stated separately, and each case must include:

The economic impact on school districts is negligible, since the districts revise existing curriculum periodically. The development of state skill standards has been widely supported by school districts.

6. The estimated cost to the agency for enforcement of the adopted regulation.

There is no estimated cost for endorsement to the regulating agency.

7. A description of any regulations of other state or government agencies which the proposed regulation overlaps or duplicates and a statement explaining why the duplication or overlapping is necessary. If the regulation overlaps or duplicates a federal regulation, the name of the regulating federal agency.

There is no duplication or overlap of state or local governmental agencies.

8. If the regulation includes provisions which are more stringent than a federal regulation which regulates the same activity, a summary of such provisions.

There are none.

9. If the regulation provides a new fee or increases an existing fee, the total annual amount the agency expects to collect and the manner in which the money will be used.

The regulations do not establish a new fee nor increase an existing fee of the regulating agency.