

# **AGRICULTURAL METALS**

## Curriculum Content Frameworks

**Please note: All assessment questions will be taken from the knowledge portion of these frameworks.**

*Prepared by*

Patrick Breeding, Greenbrier High School  
Chad Burkett, Springdale High School  
Keith Gresham, Rison High School  
Dr. Jeff Horne, Southern Arkansas University  
Josh Rice, Springdale High School  
Larry Robertson, Batesville High School  
Michael Vines, Mena High School  
Dr. Jasper S. Lee, Ronald J. Biondo, and Daniel J. Pentony  
Center for Agricultural and Environmental Research & Training (CAERT) Inc.  
Danville, IL 61832

*Facilitated by*

Karen Chisholm, Program Manager  
Office of Assessment and Curriculum  
Arkansas Department of Workforce Education

*Edited by*

Marion Fletcher, Program Manager  
Bruce Lazarus, Program Advisor  
Dr. Anne Horne, Program Advisor  
Bart Draper, Program Advisor

*Disseminated by*

Career and Technical Education  
Office of Assessment and Curriculum  
Arkansas Department of Workforce Education

# Curriculum Content Frameworks

## Agricultural Metals

Grade Levels: 10, 11, 12  
Course Code: 491007

Prerequisite: Agriculture Science and Technology;  
Agricultural Mechanics

Course Description: This course covers safety, technical information, and metal fabrication concepts. The course will develop knowledge and skill in the following areas: tool fitting, metals and metal work, metal fasteners, advanced oxyacetylene welding and cutting, and arc welding applications, including SMAW, GMAW, TIG and plasma arc processes. Supervised experience and FFA will be integrated, as appropriate throughout the course.

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# Unit 1: Introduction to Agricultural Metals

## Hours: 6

Terminology: Fabrication, Ferrous metal, Fuse, Metal, Metalworking, Steel, Welding

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
1.1 Define terminology	1.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
1.2 Examine the importance of agricultural metals	1.2.1 Identify examples of metal work in the agricultural industry, including common methods used	Foundation	Reading	Applies information to job performance [1.3.4]  Draws conclusions from what is read [1.3.12]	
	1.2.2 Use a local directory to identify examples of businesses in the local area that work with metals	Personal Management	Career Awareness, Development, and Mobility	Comprehends ideas and concepts related to metal work in the agricultural industry [3.1.3]	
	1.2.3 Investigate and assess emerging technology in agricultural metals and give a report in class	Thinking	Creative Thinking	Makes connections between seemingly unrelated ideas [4.1.6]	

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
1.3 Discuss appropriate FFA activities and supervised experiences in agricultural metals	1.3.1	List FFA activities available in agricultural metals and explain the nature of the activities, including Career Development Events and Proficiency Awards	Foundation	Arithmetic/ Mathematics	Applies computation skills to keeping records [1.1.5]
				Speaking	Asks questions to obtain information [1.5.4]
	1.3.2	Plan and/or expand supervised experiences in agricultural metal		Writing	Organizes information into an appropriate format [1.6.10]
	1.3.3	Maintain records on FFA and supervised experience participation	Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2]  Works effectively with others to reach a common goal [2.6.6]
			Personal Management	Career Awareness, Development, and Mobility	Establishes and implements a plan of action [3.1.5]  Monitors progress toward goal attainment [3.1.10]  Sets well-defined and realistic personal/career goals (short-term and long-term) [3.1.11]

## Unit 2: Safety in Agricultural Metals Work

### Hours: 5

Terminology: Decibel(dB), Hazard, Noise duration, Noise intensity, Personal Protective Equipment (PPE), Personal safety, Risk, Safety, Safety colors

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
2.1 Define terminology	2.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
2.2 Discuss the meaning and importance of safety in agricultural metals work	2.2.1 Explain hazards associated with agricultural metals	Foundation	Listening	Listens to follow directions [1.2.6]	
	2.2.2 Demonstrate proper lab procedures and first aid methods for accidents	Interpersonal	Leadership	Responds nonverbally to conversation [1.2.9]	
		Personal Management	Integrity/Honesty/Work Ethic	Encourages/Motivates members of a group or team [2.4.6]	
				Organizes group in planning and performing a specific task [2.4.9]	
				Complies with safety and health rules in a given work environment [3.2.2]	
				Follows established rules, regulations, and policies [3.2.5]	
2.3 Describe the characteristics of a safe work environment	2.3.1 Identify safety colors used in agricultural mechanics labs	Foundation	Writing	Records data [1.6.16]	
	2.3.2 Inspect the agricultural mechanics lab to determine whether proper safety colors are being used			Uses technical words and symbols [1.6.20]	
		Interpersonal	Negotiation	Writes appropriate entries [1.6.22]	
		Personal Management	Responsibility	Comprehends ideas and concepts related to safety with metal works [2.5.2]	
				Pays close attention to details [3.4.8]	

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
2.4 Describe the use of Personal Protection Equipment (PPE)	2.4.1 Identify protective clothing and equipment which should be worn/used when working with agricultural metals	Foundation	Science	Follows safety guidelines [1.4.15]	
	2.4.2 Demonstrate how PPE is used	Interpersonal	Speaking	Organizes ideas and communicates oral messages to listeners [1.5.7]	
	2.4.3 Identify protective clothing for agricultural metals work		Coaching	Helps others learn new skills [2.1.3]	
	2.4.4 Demonstrate proper actions to take if there is a fire in the agricultural metals lab	Personal Management	Integrity/Honesty/Work Ethic	Describes desirable worker characteristics [3.2.3]  Follows established rules, regulations, and policies [3.2.5]	

## Unit 3: Careers and Industry Certification

### Hours: 5

Terminology: American Welding Society (AWS), Career, Occupation, Welder

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
3.1 Define terminology	3.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
3.2 Explain the meaning and importance of certification	3.2.1 Research and report the types of certification available and the training needed for each type	Foundation	Reading	Locates pertinent information in documents such as manuals, graphs, and schedules to perform tasks [1.3.18]	
	3.2.2 Identify the meaning and role of continuing education	Personal Management	Responsibility	Exerts a high level of effort and perseverance towards goal attainment [3.4.4]	
	3.2.3 Identify organizations that promote agricultural metals work, particularly welding	Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	
3.3 Discuss employment opportunities in agricultural metals, including welding	3.3.1 List examples of jobs in the area of agricultural metals	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
	3.3.2 Identify education and skill preparation needed for entering a job	Interpersonal	Coaching	Helps others learn new skills [2.1.3]	
	3.3.3 Identify personal attributes for success in an agricultural metals occupation	Personal Management	Career Awareness, Development, and Mobility	Develops skills to locate, evaluate, and interpret career information [3.1.4]  Describes desirable worker characteristics [3.2.3]  Describes/Explains significance of integrity, honesty, and work ethics [3.2.4]	

## Unit 4: Metals and Metal Work

### Hours: 14

Terminology: Alloy, Angle, Anneal, Channel, Die, Ferrous metal, Flat, I-beam, Malleable, Nonferrous metal, Rod, Sheet metal, Tap, Tee, Tempering, Tube

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>					
What the Student Should be Able to Do		What the Instruction Should Reinforce					
Knowledge	Application	Skill Group	Skill	Description			
4.1 Define terminology	4.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]			
			Writing	Applies/Uses technical words and concepts [1.6.4]			
4.2 Discuss safety practices in cold metal work	4.2.1 List cold metal safety practices	Foundation	Listening	Comprehends ideas and concepts related to cold metal safety practices [1.2.1]			
	4.2.2 List the steps to follow in case of an accident			Listens to follow directions [1.2.6]			
4.3 Discuss the kinds of metals used and how to distinguish between them	4.3.1 Identify types of metal stock	Foundation	Reading	Locates pertinent information in documents such as manuals, graphs, and schedules to perform tasks [1.3.18]			
				4.3.2 Distinguish between ferrous and nonferrous metals	Personal Management	Exerts a high level of effort and perseverance towards goal attainment [3.4.4]	
						4.3.3 Identify the shapes of metal materials used in agriculture	Thinking

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
4.4 Select and use tools in cold metal work	4.4.1 Identify tools used in cold metal work	Foundation	Reading	Reads and follows instructions to operate technical equipment [1.3.19]	
	4.4.2 Demonstrate the use of the following cold metal tools: hacksaw, cold chisel, file, and drill	Interpersonal	Coaching	Uses appropriate materials and techniques as specified [1.3.20]	
		Thinking	Knowing How to Learn	Helps others learn new skills [2.1.3]	
4.5 Discuss the uses of taps and dies in agricultural metals work	4.5.1 Identify how tap and drill sizes are selected	Foundation	Speaking	Uses available resources to apply new skills [4.3.6]	
	4.5.2 Use tap to thread inside steel plate	Personal Management	Responsibility	Asks questions to clarify information [1.5.3]	
	4.5.3 Identify how dies are selected based on rod diameter		Speaks in a clear, concise manner [1.5.12]		
	4.5.4 Use a die to thread a steel rod	Thinking	Creative Thinking	Maintains a high level of concentration in completion of a task [3.4.7]	
			Decision Making	Finds new ways of dealing with existing problems/situations [4.1.5]	
				Evaluates information/data to make best decision [4.2.5]	

## Unit 5: Tool Fitting

### Hours: 8

Terminology: Bench stone, Concave, Convex, Hollow ground, Mushroomed, Recondition

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
5.1 Define terminology	5.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]
			Writing	Applies/Uses technical words and concepts [1.6.4]
5.2 Discuss safety practices in tool fitting	5.2.1 List potential hazards in tool fitting work	Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2]
	5.2.2 List rules of safe work with tool fitting			Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]
				Personal Management
		Thinking	Reasoning	Applies rules and principles to a new situation [4.5.1]  Extracts rules or principles from written information [4.5.4]
5.3 Identify tools that may need fitting	5.3.1 List tools that commonly need fitting	Foundation	Listening	Comprehends ideas and concepts related to tool fitting [1.2.1]
	5.3.2 List the reasons for tool fitting			Listens for content [1.2.3]
				Interpersonal
		Thinking	Seeing Things in the Mind's Eye	Organizes and processes images – symbols, pictures, graphs, objects, etc. [4.6.2]

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do			<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>		<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
5.4	Perform needed reconditioning of tools	5.4.1 List tools and equipment used in tool fitting	Foundation	Arithmetic/ Mathematics	Chooses appropriately from a variety of mathematical techniques [1.1.11]
		5.4.2 Describe use of tools and equipment in tool fitting		Listening	Comprehends ideas and concepts related to tool fitting [1.2.1]
		5.4.3 Demonstrate techniques in tool fitting	Personal Management	Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]

## Unit 6: Advanced Oxyacetylene Welding and Cutting

### Hours: 22

Terminology: Acetylene, Backfire, Cylinder, Filler rod, Flashback, Flux, Gas, Hose, MAPP® gas, Oxyfuel, Oxygen, Pierce, Propane, Spark lighter, Tack weld

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
6.1 Define terminology	6.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
6.2 Discuss safety precautions with gas welding	6.2.1 Use PPE in the operation of gas welding equipment	Foundation	Writing	Presents answers/conclusions in a clear and understandable form [1.6.13]	
	6.2.2 Wear proper protective clothing in operation of gas welding equipment	Personal Management	Integrity/Honesty/Work Ethic	Summarizes written information [1.6.17]	
	6.2.3 Properly operate gas welding equipment to assure safety, including turning on and off			Complies with safety and health rules in a given work environment [3.2.2]	
	6.2.4 Assure safety of property used with gas welding and cutting and in the vicinity of the work	Thinking	Knowing How to Learn	Describes desirable worker characteristics [3.2.3]	
				Applies new knowledge and skills to welding [4.3.1]	
				Processes new information as related to workplace [4.3.5]	
6.3 Discuss the use of gasses in metal work	6.3.1 Name and describe fuel gasses, including acetylene, MAPP® gas, propane, and natural gas	Foundation	Listening	Listens for content [1.2.3]	
	6.3.2 Explain the role of oxygen in welding and cutting	Personal Management	Reading	Comprehends written information and applies it to a task [1.3.8]	
			Responsibility	Pays close attention to details [3.4.8]	

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
6.4 Describe tools and equipment for gas welding and cutting	6.4.1	Assemble oxyacetylene equipment	Foundation	Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]
	6.4.2	Distinguish tanks (cylinders), hoses, and fittings as to use for oxygen and gas			Responds to listener feedback [1.5.10]
	6.4.3	Test hoses and connections for proper assembly and leaks	Personal Management	Responsibility	Exhibits enthusiasm in approaching and completing tasks [3.4.3]  Pays close attention to details [3.4.8]
6.5 Describe the correct flame for welding and cutting	6.5.1	Demonstrate the proper way to light a torch	Foundation	Science	Monitors variables in experiment [1.4.17]
	6.5.2	Demonstrate adjustment to obtain the correct flame for welding and cutting	Thinking	Writing	Records data [1.6.16]
	6.5.3	Distinguish between neutral, oxidizing, and carburizing flames		Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]
6.6 Explain the process of oxyacetylene cutting	6.6.1	Identify temperatures produced by cutting flames	Foundation	Writing	Applies rules of grammar, punctuation, capitalization, and spelling [1.6.3]
	6.6.2	Demonstrate proper torch setup and adjustment for cutting	Personal Management		Presents answers/conclusions in a clear and understandable form [1.6.13]
	6.6.3	Demonstrate the procedure to follow in safely cutting steel		Thinking	Organizational Effectiveness
				Creative Thinking	Develops visual aids to create audience interest [4.1.4]

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
6.7 Explain the kinds and processes of oxyacetylene welding	6.7.1 Distinguish between the kinds and uses of oxyacetylene welding	Foundation	Speaking	Adapts presentation to audience [1.5.1]
	6.7.2 Distinguish between welding with and without a filter rod			Applies/Uses technical terms as appropriate to audience [1.5.2]
	6.7.3 Identify the types and sizes of rods used in welding	Thinking	Decision Making	Organizes ideas and communicates oral messages to listeners [1.5.7]
	6.7.4 Demonstrate the ability to weld the following joints: corner weld (without rod), butt weld (with rod), and fillet (with rod)			Demonstrates decision-making skills [4.2.4]
			Reasoning	Evaluates information/data to make best decision [4.2.5] Uses logic to draw conclusions from available information [4.5.6]

## Unit 7: Advanced Shielded Metal Arc Welding (SMAW)

**Hours: 30**

Terminology: Ampere, Arc, Conductor, Duty cycle, Electrode, Electrode classification, National Electrical Manufacturers Association, Slag, Tensile strength, Voltage (volt), Wattage (watt)

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
7.1 Define terminology	7.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
7.2 Discuss safety precautions with shielded metal arc welding	7.2.1 Use PPE in the operation of welding equipment	Foundation	Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]	
	7.2.2 Wear proper protective clothing in operation of welding equipment			Speaks in a clear, concise manner [1.5.12]	
	7.2.3 Properly operate welding equipment to assure safety, including grounding and turning on and off				
7.3 Discuss tools and equipment used in shielded metal arc welding	7.3.1 Identify components of shielded metal arc welding equipment	Foundation	Reading	Applies information to job performance [1.3.4]	
	7.3.2 Set up a shielded arc welding system for operation			Identifies relevant details, facts and specifications [1.3.16]	
7.4 Discuss the kinds, uses, and storage of electrodes	7.4.1 Identify color codes and numbering systems used with electrodes	Foundation	Reading	Distinguishes between fact and opinion [1.3.11]	
	7.4.2 Select the proper kind and size of electrode for a welding job			Interprets drawings to obtain factual information [1.3.17]	
	7.4.3 Properly store electrodes to maintain quality				

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
7.5 Discuss procedures in making shielded metal arc welds	7.5.1 Identify types of welds and joints, including weave pattern and butt and fillet welds	Foundation	Reading	Comprehends written specifications and applies them to a task [1.3.9]
	7.5.2 Identify kinds of welding positions, including horizontal, vertical, and overhead			Uses appropriate materials and techniques as specified [1.3.20]
	7.5.3 Adjust welding equipment for proper weld		Speaking	Organizes ideas and communicates oral messages to listeners [1.5.7]
	7.5.4 Prepare base metal for welding, including beveling, cleaning, and positioning	Personal Management	Integrity/Honesty/Work Ethic	Complies with safety and health rules in a given work environment [3.2.2]
	7.5.5 Correctly place an electrode in a holder and position the holder, strike an arc, and safely run a bead			Responsibility
	7.5.6 Clean and inspect the quality of a bead or weld			

## Unit 8: Gas Metal Arc Welding (GMAW)

**Hours: 14**

Terminology: Argon, Carbon Dioxide (CO<sub>2</sub>), Flowmeter, Gas Metal Arc Welding (GMAW), Helium, Metal Inert Gas (MIG), Welding wire

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
8.1 Define terminology	8.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
8.2 Discuss safety precautions with gas metal arc welding	8.2.1 Use PPE in the operation of welding equipment	Foundation	Listening	Listens to follow directions [1.2.6]	
	8.2.2 Wear proper protective clothing in operation of welding equipment, including ear protection	Personal Management	Responsibility	Comprehends ideas and concepts related to safety with GMAW and MIG welding [3.4.2]	
	8.2.3 Properly operate GMAW/MIG equipment to assure safety				
8.3 Discuss tools and equipment used in gas metal arc welding	8.3.1 Identify components of GMAW/MIG equipment	Foundation	Listening	Listens to follow directions [1.2.6]	
	8.3.2 Set up a GMAW/MIG system for operation		Reading	Comprehends written information and applies it to a task [1.3.8]	
8.4 Discuss procedures in making GMAW/MIG welds	8.4.1 Demonstrate proper setting of voltage, wire speed, and shielding gas flow rate	Foundation	Listening	Receives and interprets verbal messages [1.2.8]	
	8.4.2 Properly prepare base metal for welding	Personal Management	Reading	Follows written directions [1.3.13]	
	8.4.3 Demonstrate proper positioning of welding gun to safely achieve a quality weld		Responsibility	Pays close attention to details [3.4.8]	

## Unit 9: Tungsten Inert Gas Welding (TIG)

**Hours: 8**

Terminology: Gas Tungsten Arc Welding (GTAW), Inert gas, Noble gas, Tungsten, Tungsten electrode

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
9.1 Define terminology	9.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
9.2 Discuss safety precautions with gas tungsten arc welding	9.2.1 Use PPE in the operation of welding	Foundation	Listening	Listens to follow directions [1.2.6]	
	9.2.2 Wear proper protective clothing in operation of welding equipment	Personal Management	Science	Follows safety guidelines [1.4.15]	
	9.2.3 Properly operate GTAW/TIG equipment to assure safety		Responsibility	Comprehends ideas and concepts related to safety with GTAW/TIG welding [3.1.3]	
9.3 Discuss tools and equipment used in gas tungsten arc welding	9.3.1 Identify components of gas tungsten arc welding equipment, including power supply, welding gun, and gas cylinder with flow meter	Foundation	Listening	Receives and interprets verbal messages [1.2.8]	
	9.3.2 Set up a gas tungsten arc welding system for operation	Personal Management	Reading	Identifies relevant details, facts and specifications [1.3.16]	
9.4 Discuss procedures in making gas tungsten arc welds	9.4.1 Demonstrate proper setting of electrical current and polarity and gas flow rate	Foundation	Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]	
	9.4.2 Properly prepare base metal for welding	Personal Management	Listening	Listens to follow directions [1.2.6]	
	9.4.3 Demonstrate proper positioning of welding gun to safely achieve a quality weld		Reading	Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]	
			Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]	

## Unit 10: Plasma Arc Welding and Cutting (PAW and PAC)

**Hours: 10**

Terminology: Ionized gas, Plasma, Standoff distance

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
10.1 Define terminology	10.1.1 Prepare a list of terms with definitions	Foundation	Reading	Comprehends written information for main ideas [1.3.7]
			Writing	Applies/Uses technical words and concepts [1.6.4]
10.2 Discuss safety precautions with plasma arc welding and cutting	10.2.1 Use PPE in the operation of welding and cutting equipment	Foundation	Listening	Receives and interprets verbal messages [1.2.8]
	10.2.2 Wear proper protective clothing in operation of welding and cutting equipment	Personal Management	Responsibility	Comprehends ideas and concepts related to safety with plasma arc welding and cutting [3.4.2]
	10.2.3 Properly operate plasma arc welding and cutting equipment to assure safety			
10.3 Discuss tools and equipment used in plasma arc welding and cutting	10.3.1 Identify components of plasma arc welding and cutting equipment, including control console, torch (air or water cooled), cooler, and gas cylinder with flow meter	Foundation	Listening	Receives and interprets verbal messages [1.2.8]
	10.3.2 Set up a plasma arc welding and cutting system for operation, including handheld and mechanized/computer-operated	Personal Management	Reading	Identifies relevant details, facts and specifications [1.3.16]
			Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]
10.4 Discuss procedures in making plasma arc welds	10.4.1 Demonstrate proper setting of electrical current, gas flow rate, and torch nozzle and electrode	Foundation	Listening	Listens to follow directions [1.2.6]
	10.4.2 Properly prepare base metal for welding or cutting	Personal Management	Reading	Uses written resources (books, dictionaries, directories) to obtain factual information [1.3.23]
	10.4.3 Demonstrate proper plasma arc welding and cutting to safely achieve a quality work		Responsibility	Maintains a high level of concentration in completion of a task [3.4.7]

## **Glossary**

### **Unit 1: Introduction to Agricultural Metals**

1. Fabrication – the act or process of creating or constructing something
2. Ferrous metal
3. Fuse – to blend by melting together
4. Metal – a malleable and ductile substance with a high melting point and properties that allow it to be fused together by applying heat
5. Metalworking – the craft and practice of working with metals to create useful products
6. Steel – an alloy made of iron and carbon
7. Welding – a process used to fuse metal

## Unit 2: Safety in Agricultural Metals Work

1. Decibel (dB) – a unit of sound measurement
2. Hazard – a source of danger; a condition of exposure to sources of possible injury or harm
3. Noise duration – length of time a person is exposed to sound
4. Noise intensity – the energy of sound waves
5. Personal Protective Equipment (PPE) – devices worn on the body to protect from harm
6. Personal safety – providing for the safety of people in a work environment
7. Risk – chance that a loss or injury may occur by exposure to danger or hazard
8. Safety – freedom from accidents
9. Safety colors – color paint or other substances that alert people to hazards in a work environment or laboratory

## Unit 3: Careers and Industry Certification

1. American Welding Society (AWS) – a member organization that supports the welding profession and industry, including electrode classification, education, and professionalism
2. Career – the general direction of a person's life as related to work
3. Occupation – an area of work with specific and describable duties
4. Welder – a person who welds

## Unit 4: Metals and Metal Work

1. Alloy – a mixture of two or more substances of which at least one is a metal
2. Angle – a common shape for mild steel comprised of two flat edges formed at a right angle
3. Anneal – cooling steel slowly to make it soft
4. Channel – a common shape for mild steel comprised of three flat edges formed in the shape of a C
5. Die – a tool used to make or cut threads on a rod
6. Ferrous metal – a metal containing iron
7. Flat – a common shape for mild steel comprised of one flat piece
8. I-beam – a common shape for mild steel formed as an I
9. Malleable – a metal or other material that can be shaped by pounding with a mallet (hammer) or pressure of rollers
10. Nonferrous metal – a metal that does not contain iron
11. Rod – a round cylindrical piece of metal
12. Sheet metal – metal in the form of a sheet; usually thin
13. Tap – a tool used to cut threads inside a piece of metal
14. Tee – a common shape for mild steel formed as a T
15. Tempering – controlled cooling after heating metal to attain a degree of hardness
16. Tube – a hollow cylindrical material such as a pipe

## Unit 5: Tool Fitting

1. Bench stone – a sharpening stone designed to rest on a bench
2. Concave – curved inward
3. Convex – curved outward
4. Hollow ground – a blade with teeth wider at the points than at the base
5. Mushroomed – a pushed-over or enlarged condition caused by being struck repeatedly over time
6. Recondition – restore a tool, piece of equipment, engine, or motor to good working condition

## Unit 6: Advanced Oxyacetylene Welding and Cutting

1. Acetylene – an alkyne hydrocarbon gas that burns at a high temperature in the presence of an abundance of oxygen; often used in welding and cutting metal
2. Backfire – a loud pop in a torch that generally blows out the flame
3. Cylinder – a long round tank with heavy-duty walls to hold gases under pressure
4. Filler rod – long thin rods used to add metal when brazing or welding
5. Flashback – a fire inside the torch handle that causes a squealing or hissing sound
6. Flux – a material used in metal work that removes corrosion, prevents corrosion, and promotes spread of molten solder on base metal
7. Gas – a fluid substance without definite shape or volume that can expand indefinitely
8. Hose – flexible line that serves as a conduit for gases or liquids
9. MAPP® gas – a mixture of methylacetylene and propadiene gases with superior benefits for brazing, cutting, heating, and metallizing; a registered trade name held by Airco, inc.
10. Oxyfuel – a combination of combustible gas and nearly pure oxygen to produce a flame
11. Oxygen – an atmospheric gas needed for combustion
12. Pierce – making a hole by pushing through
13. Propane – a flammable gas derived from petroleum with selected applications in metal cutting and welding; also know as LP gas
14. Spark lighter – a friction device used to initiate flames with acetylene and other gases
15. Tack weld – a weld made to temporarily hold parts in position to be welded

## Unit 7: Advanced Shielded Metal Arc Welding (SMAW)

1. Ampere – a measure of the rate of electrical flow in a conductor
2. Arc – the discharge of electricity through an air space
3. Conductor – a material that permits electrons to flow through it
4. Duty cycle – the proportion of time a motor or welder can run without overheating
5. Electrode – a metal welding rod covered a flux
6. Electrode classification – a system of identifying electrodes based on composition and intended use
7. National Electrical Manufacturers Association – an industry organization that sets standards for electrical products
8. Slag – impurities that rise to the top of the weld and harden
9. Tensile strength – the amount of tension or pull a weld can withstand
10. Voltage (volt) – a measure of electrical pressure
11. Wattage (watt) – the amount of work that can be done using one ampere at one voltage

## Unit 8: Gas Metal Arc Welding (GMAW)

1. Argon – a colorless and odorless inert gas used in some welding processes to form a shield around the welding site
2. Carbon dioxide (CO<sub>2</sub>) – a heavy, colorless gas compound formed of carbon and oxygen and does not support combustion
3. Flowmeter – devices that regulate the flow of inert gas to a torch
4. Gas Metal Arc Welding (GMAW) – a method of fusion used with very light or thin metal requiring a gaseous shield around the molten puddle
5. Helium – a light gas used in some welding processes, typically to shield heavy metals fused at high temperatures
6. Metal Inert Gas (MIG) – a group of gases that may be used in welding, including carbon dioxide, argon, and helium
7. Welding wire – special wire used in certain welding processes

## Unit 9: Tungsten Inert Gas Welding (TIG)

1. Gas Tungsten Arc Welding (GTAW) – a welding process for very thin light metals; also known as Tungsten Inert Gas (TIG) welding and heliarc welding
2. Inert gas – similar to noble gas, inert gas is a nonreactive gas under normal circumstances; e.g., helium and neon and some molecular gases such as molecular nitrogen and carbon dioxide (Note: inert gases are sometimes included with noble gases)
3. Noble gas – similar to inert gas, noble gases are chemically stable and present only in elemental form; e.g., argon, krypton, and radon
4. Tungsten – a hard metal with a high melting point, which makes it suitable for use in certain welding processes
5. Tungsten electrode – a nonconsumable electrode used in welding (a filler rod of other material may be used)

## **Unit 10: Plasma Arc Welding and Cutting (PAW and PAC)**

1. Ionized gas – a gas material in which some of the constituents have been ionized; ionization usually occurs in the presence of an electric field that involves the gain or loss of electrons
2. Plasma – an ionized gas; ionized argon is used in arc welding and cutting processes needing a high temperature in a small area
3. Standoff distance – distance between cutting or welding head electrode and metal workplace