## State of Oklahoma Welding Duty/Task Crosswalk

The following state of Oklahoma welding tasks, which are aligned to AWS standards, are covered in MAVCC'S welding series. Shielded Metal Arc Pipe Welding tasks are mostly the same as those found in Shielded Metal Arc Welding and Carbon Arc Cutting-Air. Since pipe welding uses a unique set of symbols for prints and layouts, those are addressed at the end of these standards as additional materials to complement the Crosswalk.

| **Occupation: Shielded Metal Arc Welder** | **MAVCC Tasks** |
|---|---|
| **Duty A: Demonstrate Employability Skills** | |
| A.18 Identify employment opportunities | *Fundamentals of Welding*, Unit 1, Objective 7—Job outlook for welders; Objective 9—Career opportunities for welders; Assignment Sheet 2—Compare employment opportunities in welding |
| A.19 Identify levels of training recommended for related careers | *Fundamentals of Welding*, Unit 1, Objective 8—What it takes to become a good welder |
| A.20 Understand salary, wages and benefits packages | *Fundamentals of Welding*, Unit 1, Objective 6—What welders earn |
| **Safety** | |
| A.26 Explain the purpose for safety policies | *Fundamentals of Welding*, Unit 2, Objective 4—Hazard communication; Assignment Sheet 1—Complete the student safety pledge form; Assignment Sheet 5—Identify and correct safety violations |
| A.27 Discuss the role of OSHA and EPA<br>— Locate information in MSDS | *Fundamentals of Welding*, Unit 2, Objective 6—Purposes of material safety data sheets; Student Supplement 1—Guidelines for interpreting material safety data sheets; Assignment Sheet 2—Interpret a material safety data sheet |
| A.28 Participate in OSHA training, if possible<br>— Lock Out/Tag Out | *Fundamentals of Welding*, Unit 2, Objective 8—Safety tags and their color coding; Objective 19—Instances when lockout devices should be used |
| — HAZCOM | *Fundamentals of Welding*, Unit 2, Objective 4—Hazard communication |
| — MSDS | *Fundamentals of Welding*, Unit 2, Objective 6—Purposes of MSDS; Student Supplement 1—Guidelines for interpreting MSDS; Assignment Sheet 2—Interpret a material safety data sheet |

## Crosswalk

| Occupation: Shielded Metal Arc Welder | MAVCC Tasks |
|---|---|
| — Bloodborne Pathogens | *Fundamentals of Welding*, Unit 3, Objective 18—Basic first-aid procedures for various emergency situations |
| A.29 Explain the proper steps in reporting an accident or emergency | *Fundamentals of Welding*, Unit 3, Objective 16—General steps for handling any emergency situation; Objective 17—General guidelines for first aid emergencies; Assignment Sheet 1—Determine basic first aid measures for given emergency situations |
| A.30 Explain the hazards associated with specific types of equipment and tools | *Fundamentals of Welding*, Unit 2, Objective 3—General job and shop safety rules; Assignment Sheet 5—Identify and correct safety violations<br>*GMAW/FCAW*, Unit 1, Objective 10—Rules for handling hollow casting or containers; Objective 11—Hazards associated with arc rays |
| A.31 Perform machine operator safety checks of equipment and accessories, when necessary | *Fundamentals of Welding*, Unit 2, Assignment Sheet 5—Identify and correct safety violations; Unit 4, Objective 21—Basic rules for safe use of power tools and equipment |
| A.32 Practice tool safety | *Fundamentals of Welding*, Unit 2, Objective 3d—Tool use, maintenance, and storage safety; Unit 3, Objective 9—Rules for handling welding cables and gas and coolant hoses; Unit 4, Objective 20—Rules for hand tool safety; Objective 21—Basic rules for safe use of power tools and equipment; Objective 22—Rules for tool and equipment maintenance |
| A.33 Describe the types of fire hazards found in the workplace | *Fundamentals of Welding*, Unit 2, Objective 10—Components of fire triangle; Objective 11—Types of fires and classifications; Objective 12—Types of fire extinguishers; Objective 13—Fire extinguisher markings and class of fire they represent; Objective 14—Fire extinguisher operating instructions that follow P-A-S-S; Student Supplement 2—Using Portable Fire Extinguishers; Assignment Sheet 4—Determine correct fire extinguishers to use for various situations; Job Sheet 1—Operate a fire extinguisher |

| Occupation: Shielded Metal Arc Welder | MAVCC Tasks |
|---|---|
| A.34 Discuss electrical hazards | *Fundamentals of Welding*, Unit 2, Objective 3f—Electrical safety; Unit 3, Objective 19—Treating a victim of electrical shock<br>*GMAW and FCAW*, Unit 1, Objective 7—Electrical safety requirements for GMAW |
| A.35 Demonstrate safe use of personal protective equipment | *Fundamentals of Welding*, Unit 2, Objective 20—Fall protection systems; Objective 21—Confined space entry; Objective 22—Environmental contaminants that would require you to use a respirator |
| A.36 Demonstrate safe material handling techniques<br>— Lifting<br>— Transporting<br>— Storing | *Fundamentals of Welding*, Unit 2, Objective 15—Causes of back injuries; Objective 16—Guidelines for lifting and moving items safely; Job Sheet 2—Lift a heavy object properly |
| A.37 Understand established first aid procedures | *Fundamentals of Welding*, Unit 3, Objective 16—General steps for handling any emergency situation; Objective 17—General guidelines for first aid emergencies; Objective 18—Basic first-aid procedures for various emergency situations; Student Supplement 2—A systematic look at first aid; Assignment Sheet 1—Determine basic first aid measures for given emergency situations |
| A.38 Practice good housekeeping | Oxyacetylene Welding and Oxyfuel Cutting—All job sheets require students to clean up their work areas and return tools and equipment to proper storage. |
| A.39 Comply with company safety policies | *Fundamentals of Welding*, Unit 2, Assignment Sheet 1—Complete the student safety pledge form |

## Crosswalk

| Occupation: Shielded Metal Arc Welder | MAVCC Tasks |
|---|---|
| **Basic Academic Skills** | |
| A.40 Apply mathematical operations involving whole numbers, fractions, decimals, percentages; mathematical word problems, ratios, etc., when necessary<br>— Addition<br>— Subtraction<br>— Multiplication<br>— Division | *Fundamentals of Welding*, Unit 6, Assignment Sheet 1—Add, subtract, multiply, and divide fractions; Assignment Sheet 2—Add, subtract, multiply, and divide decimal equivalents; Assignment Sheet 3—Convert fractions to decimal form, change fractions to a common denominator, and reduce fractions to lowest terms; Assignment Sheet 4—Write fractions as decimals and percents; Assignment Sheet 6—Write decimals as fractions and percents; Assignment Sheet 8—Make conversions with an inches-to-decimal conversation chart. |
| A.41 Apply advanced mathematical operations, when necessary<br>— Algebra<br>— Geometry<br>— Trigonometry<br>— Calculus<br>— Statistical Methods | *Fundamentals of Welding*, Unit 6, Objective 8—Terms used in geometry; Objective 9—Types of geometric figures; Objective 12—Area of geometric figures; Assignment Sheet 14—Calculate area of geometric figures; Job Sheet 1—Adjust a bevel square to a 45° angle using a framing square, a combination square, and a protractor; Job Sheet 2—Form 90° and 45° angles with a combination square and draw parallel lines on metal stock |
| A.42 Apply scientific principles, when necessary<br>— Physics<br>— Chemistry | *Fundamentals of Welding*, Unit 5, Objective 4—Metal identification tests; Objective 5—Mechanical properties of metals; Objective 6—Types of mechanical strengths, Objective 7—Physical property of metals; Job Sheet 1—Conduct magnet tests to identify common metals used in welding; Job Sheet 2—Conduct chisel test to identify common metals used for welding; Job Sheet 3—Conduct spark tests to identify common metals used for welding |
| A.43 Interpret charts, table, and graphs | *Fundamentals of Welding*, Unit 6, Assignment Sheet 7—Make conversions decimals with a decimal equivalent chart; Assignment Sheet 8—Make conversations with an inches-to-decimal conversion chart |
| A.44 Apply reading and writing skills, when necessary | Most assignment sheets require the student to read and write. |

| Occupation: Shielded Metal Arc Welder | MAVCC Tasks |
|---|---|
| **Blueprint Reading** | |
| A.50 Identify basic elements of blueprints<br><br>— Terms<br>— Components<br>— Symbols | *Fundamentals of Welding*, Unit 7, "Welding Print Reading"<br>*Fundamentals of Welding*, Unit 7, Objective 1—Terms related to print reading; Objective 2—Basic lines; Objective 13—Symbols |
| A.51 Discuss different types of drawings | *Fundamentals of Welding*, Unit 7, Objective 4—Isometric and oblique drawings |
| A.52 Interpret drawings<br><br>— Bill of Materials<br>— Revisions<br>— Tolerances | *Fundamentals of Welding*, Unit 7, Objective 4—Isometric and oblique drawings; Objective 6—Tolerancing; Objective 15—Requirements for a formal bill of material; Objective 16—Requirements for an informal bill of material; Assignment Sheet 5—Interpret tolerance dimensions in decimals, fractions, and degrees; Unit 8, Assignment Sheet 5—Interpret a welding print and welding procedure specifications |
| A.53 Interpret symbols | *Fundamentals of Welding*, Unit 7, Objective 13—Symbols |
| **Measurement Tools and Techniques** | |
| A.54 Identify types of measuring instruments | *Fundamentals of Welding*, Unit 6, Objective 6—Types of rules and examples of their graduations |
| A.55 Use appropriate measurement instrument for a measurement task | *Fundamentals of Welding*, Unit 6, Job Sheet 2—Form 90° and 45° angles with a combination square and draw parallel lines on metal stock |
| A.56 Read measuring instruments | *Fundamentals of Welding*, Unit 6, Objective 7—Steps in reading a rule; Assignment Sheet 9—Measure distances with 1″, 1/2″, and 1/4″ graduations; Assignment Sheet 10—Measure distances with 1/4″ and 1/8″ graduations; Assignment Sheet 12—Measure distances with 1/16″ graduations; Job Sheet 1—Adjust a bevel square to a 45° angle using a framing square, a combination square, and a protractor; Job Sheet 2—Form 90° and 45° angles with a combination square and draw parallel lines on metal stock |

## Crosswalk

| Occupation: Shielded Metal Arc Welder | MAVCC Tasks |
|---|---|
| A.57 Identify the appropriate formula and units for a measurement task | *Fundamentals of Welding*, Unit 6, Objective 11—Squares, rectangles, and triangles and their formulas for calculating their perimeters; Objective 12—Area of geometric figures |
| A.58 Differentiate between English and Metric measurement systems, when necessary | *Fundamentals of Welding*, Unit 6, Objective 13—English-metric conversion charts and how to use them; Assignment Sheet 13—Make conversations with an English-metric conversion chart |
| A.59 Communicate measurements using proper symbols or words | *Fundamentals of Welding*, Unit 6, Objective 10—Units of measure and their equivalents |
| **Duty B: Interpret Drawing and Welding Symbols and Written Welding Procedures** | |
| B.01 Interpret basic elements of drawing/sketch | *Fundamentals of Welding*, Unit 7—Welding Print Reading (entire unit) |
| — Structural members | *Fundamentals of Welding*, Unit 7, Objective 14—Structural shapes |
| — Sequence of assembly | *Fundamentals of Welding*, Unit 7, Assignment Sheet 8—Construct adjacent parts in an assembly section |
| — Dimensions of tolerances | *Fundamentals of Welding*, Unit 7, Objective 5—Dimensioning; Objective 7—Methods of dimensioning; Assignment Sheet 5—Interpret tolerance dimensions in decimals, fractions, and degrees |
| — Scale | *Fundamentals of Welding*, Unit 7, Objective 9—Reduction and enlargement scales |
| — View interpretation | *Fundamentals of Welding*, Unit 7, Objective 3—Basic views; Objective 12—Types of section views; Student Supplement 2—Orthographic projection; Assignment Sheet 1—Construct a top view; Assignment Sheet 2—Construct a front view; Assignment Sheet 3—Construct a right side view; Assignment Sheet 7—Make a three-view sketch |

| Duty C: Perform Shielded Metal Arc Welding | |
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| **Occupation: Shielded Metal Arc Welder** | **MAVCC Tasks** |
| C.01 Perform safety inspection of equipment and accessories<br>— Protective clothing and equipment<br>— Cables<br>— Communicate hazard warnings<br>— Work areas | *SMAW and CAC-A*, Units 2 and 3 require student to inspect workplace before beginning a task, safely arrange equipment and materials, and maintain a hazard-free work area including proper shutdown of welding machine and safe storage of cables and other equipment. |
| C.02 Make minor external repairs to equipment and accessories (preventive maintenance only)<br>— Manufacturer's recommendations<br>— Company repair policy | *SMAW and CAC-A*, Units 2 and 3 require student to follow recommended guidelines for selecting tools and materials for all job sheets and to inspect the workplace before starting welding activity. |
| C.03 Set up shielded metal arc welding on plain carbon steel plate and pipe<br>— E7024, E6010, or E6011 and E7018 electrodes<br>— Base/filler metal selection/ identification/preparation<br>— Review appropriate weld procedures<br>— Filler metal selection<br>— Proper hand tool selection<br>— Adjust voltage and polarity<br>— Base metal preparation<br>— Parts set up and preheated as necessary | *SMAW and CAC-A*, Units 2, 32 job sheets guide student through practice with running a bead on plain carbon steel plate. Pipe welding is covered in MAVCC's Shielded Metal Arc Pipe Welding. Unit 2 job sheets (32 in all) have student weld fillet weld lap joints and T-joints in all positions, flat, horizontal, vertical, and overhead with E6010, E7024 and E7018 electrodes. Job sheets also have student weld V-groove butt joints in flat, horizontal, vertical and overhead positions with E6010, and E7018 electrodes. In all job sheets, student must complete basic metal preparation and adjust voltage and polarity for given application. V-groove preparation requires oxyacetylene preheating and cutting, and proceeds to cleaning and grinding to specifications. Student must prepare and conduct a bend test on V-groove joints. |
| **Duty G: Perform Manual Oxyfuel (OF) Cutting** | |
| **Occupation: Shielded Metal Arc Welder** | **MAVCC Tasks** |
| G.01, G.02, G.03, G.04, G.05, G.06, G.07, and G.09 cover safety, equipment use, and procedures for oxyfuel cutting. | See MAVCC's *Oxyacetylene Welding and Oxyfuel Cutting* for detailed duty/task. Unit 3, "Hardfacing" in MAVCC's *Shielded Metal Arc Welding and Carbon Arc Cutting—Air* contains Job Sheet 2 which provides an optional student preparation of test plates with oxyfuel cutting. |

## Crosswalk

| Duty I: Perform Air Carbon Arc Cutting (Gouging) | |
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| **Occupation: Shielded Metal Arc Welder** | **MAVCC Tasks** |
| I.01, I.02, I.03, I.04, and I.05 cover safety, equipment use, and procedures for carbon arc cutting (gouging) | *Shielded Metal Arc Welding and Carbon Arc Cutting—Air*. Unit 4, "Carbon Arc Cutting—Air" has Job Sheet 1 which requires student to set up equipment, test air supply for moisture, and gouge a piece of mild steel. Job Sheet 2 of same unit requires student to backgouge a V-groove butt joint to assure complete fusion for the weldment. |
| **Duty K: Perform Welding Inspection and Testing** | |
| **Occupation: Shielded Metal Arc Welder** | **MAVCC Tasks** |
| K.01 Examine cut surfaces and edges or prepared base metal parts<br>— Appearance<br>— Uniformity<br>— Proper fit-up<br>— Base metal preparation | *SMAW and CAC—A,* Job sheets in Units 2 and 3 require student to inspect all welds from first bead quality to final pass for shielded metal arc welds on lap joints and T-joints in all positions. Students must also prepare mild steel V-groove butt joints for welding in all positions for welding and prepare a test specimen and conduct a bend test to evaluate all V-groove butt joint welds. |
| K.02 Examine tack, intermediate layers, and completed welds<br>— Visual check for weld discontinuity and defects to an acceptable criteria<br>— Destructive or non-destructive examination | *SMAW and CAC—A,* Job sheets in Units 2 and 3 require check of base metal before welding process begins, examination of initial bead and all passes and cleaning and visual inspections of final pass or bead. Specimens must be prepared to bend test V-groove butt joints, and specimens must be tested and evaluated. |

| Duty: Demonstrate print reading/layout skills | |
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| **Occupation: Shielded Metal Arc Welder** | **MAVCC Tasks** |
| Skill: Identify common piping symbols | *Shielded Metal Arc Pipe Welding*, Unit 2, Objective 2. |
| Identify methods of dimensioning pipe for pipe welding. | *Shielded Metal Arc Pipe Welding*, Unit 2, Objective 5. |
| Recognize advantages of isometric drawings for pipe welding layout. | *Shielded Metal Arc Pipe Welding*, Unit 2, Objective 8. |
| Solve trigonometry problems unknown sides and angles. | Assignment Sheets 1 & 2, Unit 2, *Shielded Metal Arc Pipe Welding*. |
| Develop a template for a two-piece 90° turn. | Job Sheet 1, Unit 2, *Shielded Metal Arc Pipe Welding*. |
| Develop a template for a 90° branch with pipes of equal size. | Job Sheet 2, Unit 2, *Shielded Metal Arc Pipe Welding*. |
| Develop a template for a 45° branch connection. | Job Sheet 3, Unit 2, *Shielded Metal Arc Pipe Welding*. |