Course Name: Welding Technology

Name: Occupational Orientation and Safety

Unit Number: PA-100

Hours: 36

Unit Description/Objectives:
Upon completion of this unit the student will be able to demonstrate basic knowledge of laboratory organization, including safety standards and procedures for trade facilities.

Tasks:
L100a - Demonstrate awareness of the occupational requirements of Welding

PA101 - Prepare and mark time on job sheet, reports or records.

PA102 - Perform housekeeping duties daily.

PA103 - Follow verbal instructions to complete work assignments and rules.

PA104 - Follow written instructions to complete work assignments and rules.

PA105 - Demonstrate proper use and inspection of Personal Protection Equipment (PPE).

PA106 - Demonstrate proper work area operation.

PA107 - Demonstrate proper use of ventilation equipment.

PA108 - Discuss Proper Hot Zone operation.

PA109 - Demonstrate knowledge of proper work actions for working in confined spaces.

PA110 - Demonstrate knowledge of SDS sheets and precautionary labeling.

PA111 - Demonstrate proper use and inspection of equipment used for each required welding and thermal cutting process.

PA112 - Display familiarity with industrial and OSHA safety standards.

PA113 - Demonstrate knowledge of oxy-fuel safety procedures.

PA114 - Demonstrate knowledge of arc welding safety procedures.

PA115 - Demonstrate emergency action plan (all inclusive).
Focus Standard
13.2.11 E Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to: commitment, communication, dependability, health/safety, laws and regulations (that is Americans with Disabilities Act, Child Labor Law, Fair Labor Standards Act, OSHA, Material Safety Data Sheets), personal initiative, Self-advocacy, scheduling/time management, team building, technical literacy and technology.

Supporting Standards
3.4.10. E7 Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.
3.4.12. B1 Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of technologies.

Connecting Standard
3.4.10. A2 Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems.
3.4.10. E7 Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.

Instructional Activities:

Knowledge:
- Explain awareness of the occupational requirements of Welding
- Discuss proper use and inspection of Personal Protection Equipment
- Discuss proper Hot Zone operation
- Discuss knowledge of SDS sheets and precautionary labeling
- Explain industrial and OSHA safety standards.

Skill:
- Demonstrate proper use and inspection of Personal Protection Equipment (PPE).
- Demonstrate knowledge of Oxy-Acetylene Equipment safety procedures
- Demonstrate safety techniques for storing cylinders
- Demonstrate knowledge of Arc Welding Equipment safety procedures
- Operate Forced Draft Ventilation Equipment
- Demonstrate safety techniques
- Demonstrate proper material handling methods

Remediation:
- Review with teacher assistance
- Worksheets
- Reading Comprehension Strategies
- Retest or alternative assessment
- Study guides

Enrichment:
- Provide live work/practical assignments for assessments
Safety:

Student must wear required shop uniform to include:
- Safety Glasses
- Fire-resistant (FR) Head Covering
- FR Jacket
- Leather gloves
- Welding Shield
- Leather Work Boots

Handle material in a safe and work like manner
Use protective clothing and equipment
Use adequate ventilation when working in enclosed area
Use proper safety precautions when using /operating hand tools
Use tools and equipment according to OSHA standards
Know and follow the established safety rules at all times

Assessment:

- Daily Worksheets
- Tests
- Quizzes
- Individual projects
- Rubrics

Resources:


Equipment:

- None required for this unit
Course Name: Welding Technology

Unit Name: Principles of Welding

Unit Number: PA-200

Hours: 50

Unit Description/Objectives:
Upon completion of this unit the student will be able to identify, describe and select various types of metals and describe their reaction to heat, identify joint designs and understand welding codes and procedures. Student will also be able to demonstrate the use hand tools, measuring equipment and power equipment.

Tasks:
PA201 - Identify major types of metals (ferrous and non-ferrous) used in welding.

PA202 - Describe the basic principles of heat, expansion and contraction as it relates to metals.

PA203 - Select appropriate welding technique, equipment and supplies for a given metal or process.

L203a – Demonstrate knowledge of how transformer and inverter power sources operate.

PA204 - Describe the industry accepted welding codes, standards and procedures and their use.

PA205 - Identify various joint designs (joint geometry).

PA206 - Clean and prepare materials for welding and/or cutting.

PA207 - Demonstrate proper use of hand tools.

PA208 - Demonstrate proper use of standard measuring and layout tools.

PA209 - Demonstrate proper use of power equipment.

L209a - Demonstrate the ability to operate a horizontal band saw.

L209b - Demonstrate the ability to operate a hydraulic shear.

L209c - Demonstrate the ability to operate a pedestal/bench grinder.

L209d - Demonstrate the ability to operate a portable grinder.
Standards / Assessment Anchors

Focus Standard
CC.3.5.11-12. C Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standard
CC.3.5.9-10.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.11-12.D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

Connecting Standard
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.

Supporting Standard
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Instructional Activities:

Knowledge:
Identify some common hazards in welding, storing and handling cylinders.
Identify and explain job code specifications
Identify positions of welding
Identify joint design
Identify methods of joint and surface preparation
Identify and explain distortion and how it is controlled
Differentiate between ferrous and nonferrous metals
Identify arc, voltage and travel speed
Complete required theory tests on power equipment including:
   Horizontal Band Saw
   Pedestal Grinder
   Portable Grinder
   Hydraulic Shear/Punch

Skill:
Clean and prepare materials for welding and/or cutting
Demonstrate proper use of power equipment by completing required qualification tests:
   Horizontal Band Saw
   Pedestal Grinder
   Portable Grinder
   Hydraulic Shear/Punch
Demonstrate proper use of hand tools:
   Ball Peen Hammers
   Files
   Wrenches
   Screwdrivers
   Hand brushes
   Chisels
   Clamps
   Vises
   Vice Grips
Demonstrate proper use of measuring and layout tools:
- Tape Measure
- Straight edges
- Levels

Demonstrate proper use of inspection tools:
- Hi-lo gages
- Fillet gauges

Demonstrate Proficiency in Welding Techniques:
- Determining appropriate electrical amperage/voltage
- Determining proper welding electrodes and filler wires to match base material
- Place Welding bead layout appropriate to strength demands
- Manipulate electrode and filler metal beads to meet demands of visual inspection

Remediation:
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides

Enrichment:
- Provide live work/practical assignments for assessments

Safety:
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Leather gloves
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use proper safety precautions when using /operating hand tools
- Use tools and equipment according to OSHA standards
- Know and follow the established safety rules at all times

Assessment:
- Daily Worksheets
- Tests
- Quizzes
- Rubrics
- Individual projects

Resources:


Equipment:

**Measuring Equipment**
- Soapstone
- Tape measures
- Combination Square
- Framing Square

**Power Equipment**
- Horizontal Band saw
- 50 ton Hydraulic Shear/punch
- Pedestal grinder

**Portable Power Equipment**
- Hand Drill
- Hand grinder
- Power wire brushes

**Hand Tools**
- Ball Peen Hammers
- Chipping Hammers
- Wire brushes
- Metal Files
- Combination wrenches
- Socket wrench sets
- Screwdrivers
- Cold Chisels
- C-clamps
- Pliers/Vice Grips
- Bench Vises

**Safety Equipment**
- Safety glasses
- Leather gloves
- Work boots

**Welding Process Equipment**
- None required for this unit
Steel Center for Career and Technical Education
Course Name: Welding Technology
Unit Name: Welding, Drawing and Weld Symbol Interpretation

Unit Number: PA-300

Hours: 50

Unit Description/Objectives:
Upon completion of this unit the student be able to identify types of lines, differentiate between types of dimensions, notes and bills of materials. The student will also be able to interpret working drawings and interpret basic welding symbols.

Tasks:
PA301 - Interpret basic elements of a drawing or sketch.
PA302 - Interpret welding symbol information.
PA303 - Fabricate parts from a drawing or sketch (class project).
L303a – Demonstrate the ability to create job material lists and calculate job cost.
PA304 - Identify structural metals used in the metal fabrication field.
PA305 - Demonstrate knowledge of basic metric conversion.
L306 – Demonstrate knowledge of basic shop math.
L306a – Demonstrate the use of right angle trigonometry.

Standards / Assessment Anchors

Focus Standard
CC.2.3.7. A.1 Solve real-world and mathematical problems involving angle measure, area, surface area, circumference, and volume.

Supporting Standard
CC.2.4.5. A.1 Solve problems using conversions within a given measurement system.
CC.2.3.6. A.1 Apply appropriate tools to solve real-world and mathematical problems involving area, surface area, and volume.

Connecting Standard
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.

Supporting Standards
CC.3.5.9-10. D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
CC.3.5.11-12. D. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
**Instructional Activities:**

**Knowledge:**
- Identify types of lines
- Differentiate types of dimensions
- Differentiate types of notes
- Understand types of bills of materials
- Interpret basic elements of a welding detail drawing
- Identify and explain the various parts of a welding symbol

**Skill:**
- Develop basic welding drawings
- Draw basic welding symbols
- Interpret a blueprint and sketches
- Fabricate parts from a drawing or sketch
- Read welding symbols on drawings, specifications and welding procedure specifications
- Identify and explain fillet and groove weld symbols

**Remediation:**
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Study guides

**Enrichment:**
- Provide live work/practical assignments for assessments

**Safety:**
- No PPE required, classroom activity only

**Assessment:**
- Tests
- Worksheets
- Quizzes
- Rubrics
- Individual projects

**Resources:**
- American Welding Society, 2003 Welding Levels I and II, "National Center for Construction Education and Research Welding"
- Technical drawings with welding symbols, notes, diagrams and measurement standards

**Equipment:**
- None required for this unit
Unit Description/Objectives:
Upon completion of this unit the student will be able to develop a technical understanding of poor welding results and how they occur, describe non-destructive and destructive weld examination practices and describe welder performance testing processes.

Tasks:
PA401 - Evaluate cut surfaces and edges of prepared base metal parts for testing.
PA402 - Identify and evaluate weld discontinuities as per accept/reject criteria.
PA403 - Demonstrate visual inspection and destructive and non-destructive techniques.

Standards / Assessment Anchors

Focus Standard
CC.3.5.11-12. C Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards
CC.2.4.5. A.1 Solve problems using conversions within a given measurement system.
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.

Connecting Standard/Anchor
CC.2.1.7. D.1 Analyze proportional relationships and use them to model and solve real-world and mathematical problems.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.4.5. A.1 Solve problems using conversions within a given measurement system.

Instructional Activities:

Knowledge:
Identify codes governing welding
Identify weld imperfections and their causes
Identify and explain welder qualification tests
Explain the importance of quality workmanship
Identify common destructive testing methods
Identify common non-destructive testing methods
Interpret inspection criteria on blueprints and sketches
Skill:
Evaluate cut surfaces and edges of prepared base metal parts for testing
Perform an evaluation of weld discontinuities as per accept/reject criteria

Remediation:
Review with teacher assistance
Worksheets
Retest or alternative assessment
Study guides

Enrichment:
Provide live work/practical assignments for assessments

Safety:
Student must wear required shop uniform to include:
  Safety Glasses
  Leather Work Boots
Handle material in a safe and work like manner
Use protective clothing and equipment
Use hand tools in a safe manner
Follow manufacturer's directions when using any product, tool, equipment, etc.
Use proper safety precautions when using/operating hand tools
Use tools and equipment in a professional work like manner according to OSHA standards
Know and follow the established safety rules at all times

Assessment:
Daily Worksheets
Tests
Worksheets
Quizzes
Rubrics
Individual projects

Resources:


Equipment:
Hi-low gages
Fillet gages
Course Name: Welding Technology

Unit Name: Shielded Metal Arc Welding (SMAW)

Unit Number: PA-500

Hours: 400

Unit Description/Objectives:
Upon completion of this unit the student will be able to identify and demonstrate SMAW safety practices, identify and describe SMAW equipment, demonstrate SMAW set-up, describe SMAW electrode classification system, describe handling and storage of electrodes and explain how to select the proper electrode. The student will also be able to demonstrate how to strike an arc and produce welds in the Flat (1F, 1G) Horizontal (2F, 2G), Vertical (3F, 3G) and Overhead (4F, 4G) positions, on Carbon Steel plate using 6010, 7018 welding electrodes.

Tasks:

PA501 - Perform safety inspections of SMAW equipment and accessories.

PA502 - Make minor external repairs to SMAW equipment and accessories.

PA503 - Set up and operate SMAW equipment.

L503a – E6013 perform circles and stringers on flat plate.

L503b – E6013 perform pad welds on flat plate.

L503c – E7018 perform pad welds on flat plate.

L503d – E6010 perform pad welds on flat plate.

L503e – E6010 perform pad welds on flat plate – horizontal position.

L503f – E7018 perform pad welds on flat plate – horizontal position.

PA504 - Make fillet welds in all positions.

L504a – Cut and fit plates for horizontal fillet weld.

L504b – E6010 complete a three pass tee joint (1F) fillet weld.

L504c – E7018 complete a three pass tee joint (1F) fillet weld.

L504d – E6010 complete a three pass tee joint (2F) fillet weld.

L504e – E7018 complete a three pass tee joint (2F) fillet weld.

L504f – E6010 complete a three pass stringer beads vertical up (3F) fillet weld.

L504g – E7018 complete a three pass stringer beads vertical up (3F) fillet weld.

L504h – Complete a three pass vertical up (3F) fillet with E6010 root E7018 fill and cover.

L504i – E6010 complete a three pass overhead (4F) fillet weld.
L504j – E7018 complete a three pass overhead (4F) fillet weld.
L504k – E6010 complete a one pass lap joint 2F position.
L504l – E7018 complete a one pass lap joint 2F position.
L504m – E6010 complete a one pass lap joint 4F position.
L504n – E7018 complete a one pass lap joint 4F position.

PA505 - Make groove welds in all positions.
L505a – E7018 complete a “V” bevel groove weld with backing strip – flat (1G) position.
L505b – E7018 complete a “V” bevel groove weld with backing strip – horizontal (2G) position.
L505c – E7018 complete a “V” bevel groove weld with backing strip – vertical up (3G) position.
L505d – E7018 complete a “V” bevel groove weld with backing strip – overhead (4G) position.
L505e – Perform open-root “V” bevel groove weld – flat (1G) position with E6010 root and E7018 fill and cover.
L505f – Perform open-root “V” bevel groove weld – horizontal (2G) position with E6010 root and E7018 fill and cover.
L505g – Perform open-root “V” bevel groove weld – vertical up (3G) position with E6010 root and E7018 fill and cover.
L505h – Perform open-root “V” bevel groove weld – overhead (4G) position with E6010 root and E7018 fill and cover.

PA506 - Pass performance test in all positions.
PA507 - Perform qualification test.

Standards / Assessment Anchors

**Focus Standard**
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

**Supporting Standard**
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
3.2.10.B4. Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.

**Connecting Standard**
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

**Supporting Standard**
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems.
Instructional Activities:

**Knowledge:**
- Identify and explain SMAW safety
- Identify and explain welding electrical current
- Identify and explain SMAW machines
- Explain setting up SMAW equipment
- Identify and explain tools for weld cleaning
- Identify factors that affect electrode selection
- Explain the A.W.S. filler metal classification systems
- Identify different types of filler metals
- Explain the storage and control of filler metals

**Skill:**
- Demonstrate safety inspections of SMAW equipment and accessories.
- Demonstrate minor external repairs to SMAW equipment and accessories.
- Demonstrate set up and operate SMAW equipment.
- Demonstrate welding circles and stringers on flat plate.
- Demonstrate welding pad welds on flat plate.
- Demonstrate welding pad welds on flat plate - horizontal position.
- Demonstrate cutting and fitting plates for horizontal tee joint and fillet weld.
- Demonstrate welding a three pass tee joint (2F), fillet weld.
- Demonstrate welding a three pass stringer beads vertical up (3F) fillet weld.
- Demonstrate welding a three pass vertical up (3F) fillet E6010 root E7018 weave.
- Demonstrate welding a three pass overhead (4F) fillet weld.
- Demonstrate welding a one pass lap joint (2F) fillet weld.
- Demonstrate welding a one pass lap joint (4F) fillet weld.
- Demonstrate welding a "V" bevel groove weld with backing strip (1G)
- Demonstrate welding a "V" bevel groove weld with backing strip (2G)
- Demonstrate welding a "V" bevel groove weld with backing strip (3G)
- Demonstrate welding a "V" bevel groove weld with backing strip (4G)
- Demonstrate welding an open-root "V" bevel groove weld (1G)
- Demonstrate welding an open-root "V" bevel groove weld (2G)
- Demonstrate welding an open-root "V" bevel groove weld (3G)
- Demonstrate welding an open-root "V" bevel groove weld (4G)

**Remediation:**
- Review with teacher assistance
- Worksheets
- Reading Comprehension Strategies (Max Teaching)
- Retest or alternative assessment
- Study guides

**Enrichment:**
- Provide live work/practical assignments for assessments

**Safety:**
Student must wear required shop uniform to include:
- Safety Glasses
- Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Welding Shield
  - Leather Work Boots
- Use protective clothing and equipment
- Use adequate ventilation when working in enclosed area
- Use tools and equipment in a professional work like manner according to OSHA standards
- Know and follow the established safety rules at all times
**Assessment:**
- Daily Worksheets
- Tests
- Quizzes
- Rubrics
- Individual projects

**Resources:**


**Equipment:**

**Safety Equipment/PPE:**
- M.S.D.S.
- Forced Draft Ventilation Equipment

**Hand Tools:**
- Chipping Hammers
- Wire brushes
- C-clamps
- Pliers/Vice Grips

**Welding Process Equipment/Materials**
- SMAW machine
- Electrode Holder
- Ground clamp
- Welding electrodes

**Power Equipment**
- 50 ton Hydraulic Shear/punch
- Pedestal grinder

**Portable Power Equipment**
- Hand grinder
- Power wire brushes
Unit Description/Objectives:
Upon completion of this unit the student will be able to identify and demonstrate GMAW safety practices, identify and describe GMAW equipment, demonstrate GMAW set-up, describe GMAW electrode wire and shielding gases. The student will also be able to demonstrate how to produce welds in the Flat (1F, 1G) Horizontal (2F, 2G), Vertical (3F, 3G) and Overhead (4F, 4G), positions on Carbon Steel plate using the short-circuit transfer process.

Tasks:
PA601 - Perform safety inspections of GMAW equipment and accessories.
PA602 - Make minor external repairs to GMAW equipment and accessories.
PA603 - Set up and operate GMAW equipment.
L603a – Perform GMAW pad welds on flat plate.
L603b – Perform GMAW pad welds on flat plate – horizontal position.
PA604 - Make fillet welds in all positions.
L604a – Perform GMAW three pass fillet weld tee joint – flat (1F) position.
L604b – Perform GMAW three pass fillet weld tee joint – horizontal (2F) position.
L604c – Perform GMAW three pass fillet weld tee joint – vertical down (3F) position.
L604d – Perform GMAW three pass fillet weld tee joint – vertical up (3F) position.
L604e – Perform GMAW three pass fillet weld tee joint – overhead (4F) position.
L604f – Perform GMAW one pass lap joint 2F position.
L604g – Perform GMAW one pass lap joint 4F position.
PA605 - Make groove welds in all positions.
L605a – Perform GMAW "V" bevel groove weld with backing strip – flat (1G) position.
L605b – Perform GMAW "V" bevel groove weld with backing strip – horizontal (2G) position.
L605c – Perform GMAW "V" bevel groove weld with backing strip – vertical (3G) position.
L605d – Perform GMAW "V" bevel groove weld with backing strip – overhead (4G) position.
L605e – Perform GMAW open-root "V" bevel groove weld – flat (1G) position.
L605f – Perform GMAW open-root "V" bevel groove weld – horizontal (2G) position.
L605g – Perform GMAW open-root “V” bevel groove weld – vertical (3G) position.

L605h – Perform GMAW open-root “V” bevel groove weld – overhead (4G) position.

PA606 - Pass performance test.

Standards / Assessment Anchors

Focus Standard
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
3.2.10.B4. Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.

Connecting Standard
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

Instructional Activities:

Knowledge:
- Explain Gas Metal Arc Welding (GMAW) safety
- Identify and explain the use of GMAW equipment
- Identify and explain the use of GMAW filler metals
- Identify and explain the use of GTAW shielding gases
- Explain how to perform minor external repairs to GMAW equipment and accessories
- Explain how to set up/prepare to perform GMAW operations on carbon steel
- Explain the characteristics of welding current and power sources
- Identify and explain the use of FCAW equipment:
  - Spray transfer
  - Globular
  - Short circuiting pulse

Skill:
- Demonstrate safety inspections of GMAW equipment and accessories.
- Demonstrate minor external repairs to GMAW equipment and accessories.
- Demonstrate set up and operation of GMAW equipment.
- Perform welding pad welds on flat plate.
- Perform welding pad welds on flat plate – horizontal position.
- Perform welding three pass fillet weld tee joint (1F) position.
- Perform welding three pass fillet weld tee joint (2F) position.
- Perform welding three pass fillet weld tee joint, vertical down (3F) position.
- Perform welding three pass fillet weld tee joint, vertical up (3F) position.
- Perform welding three pass fillet weld tee joint (4F) position.
- Perform welding one pass lap joint (2F) position.
- Perform welding one pass lap joint (4F) position.
- Perform welding “V” bevel groove weld with backing strip (1G) position.
- Perform welding “V” bevel groove weld with backing strip (2G) position.
- Perform welding “V” bevel groove weld with backing strip (3G) position.
- Perform welding “V” bevel groove weld with backing strip (4G) position.
Perform welding open-root “V” bevel groove weld (1G) position.
Perform welding open-root “V” bevel groove weld (2G) position.
Perform welding open-root “V” bevel groove weld (3G) position.
Perform welding open-root “V” bevel groove weld (4G) position.

Remediation:
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides
- Checklists

Enrichment:
- Provide live work/practical assignments for assessments

Safety:
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Welding Shield
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use protective clothing and equipment
- Use hand tools in a safe manner
- Use adequate ventilation when working in enclosed area
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using /operating hand tools
- Use tools and equipment in a professional work like manner according to OSHA standards
- Know and follow the established safety rules at all times

Assessment:
- Daily Worksheets
- Quizzes
- Tests
- Rubrics
- Individual projects

Resources:
Equipment:

**Safety Equipment:**
M.S.D.S.
Forced Draft Ventilation Equipment

**Hand Tools:**
Wire brushes
C-clamps
Pliers/Vice Grips

**Welding Process Equipment/Materials**
GMAW machine
Wire feeder
Gun
Ground clamp
Solid Wire-Filler material
Gas Cylinder
Anti-spatter spray
Carbon steel plate

**Power Equipment**
50 ton Hydraulic Shear/punch
Pedestal grinder

**Portable Power Equipment**
Hand grinder
Power wire brushes
Course Name: Welding Technology  
Unit Name: Flux Cored Arc Welding (FCAW)  
Unit Number: PA-700  

Hours: 70

Unit Description/Objectives:
Upon completion of this unit the student will be able to identify and demonstrate FCAW safety practices, identify and describe FCAW equipment, demonstrate FCAW set-up, describe FCAW electrode wire and shielding gases. The student will also be able to demonstrate how to produce welds in the Flat (1F, 1G) Horizontal (2F, 2G), Vertical (3F, 3G) and Overhead (4F, 4G), positions on Carbon Steel plate.

Tasks:
PA701 - Perform safety inspections of Flux Cored Arc equipment and accessories.
PA702 - Make minor external repairs to Flux Cored Arc equipment and accessories.
PA703 - Set up and operate FCAW equipment.
L703a – Perform FCAW pad welds on flat plate.
L703b – Perform FCAW pad welds on flat plate – horizontal position.
PA704 - Make fillet welds in all positions.
L704a – Perform FCAW three pass fillet weld tee joint – flat (1F) position.
L704b – Perform FCAW three pass fillet weld tee joint – horizontal (2F) position.
L704c – Perform FCAW three pass fillet weld tee joint – vertical up (3F) position.
L704d – Perform FCAW three pass fillet weld tee joint – overhead (4F) position.
L704e – Perform FCAW one pass lap joint 2F position.
L704f – Perform FCAW one pass lap joint 4F position.
PA705 - Pass performance test.
PA706 - Demonstrate a groove weld in all positions.
L706a – Perform FCAW “V” bevel groove weld with backing strip – flat (1G) position.
L706b – Perform FCAW “V” bevel groove weld with backing strip – horizontal (2G) position.
L706c – Perform FCAW “V” bevel groove weld with backing strip – vertical (3G) position.
L706d – Perform FCAW “V” bevel groove weld with backing strip – overhead (4G) position.
L706e – Perform FCAW open root “V” bevel groove weld – flat (1G) position.
L706f – Perform FCAW open root “V” bevel groove weld – horizontal (2G) position.
L706g – Perform FCAW open root “V” bevel groove weld – vertical (3G) position.
L706h – Perform FCAW open root “V” bevel groove weld – overhead (4G) position.

Standards / Assessment Anchors

Focus Standard
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
3.2.10.B4. Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.

Connecting Standard
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

Instructional Activities:

Knowledge:
Complete Daily Worksheets
Explain flux core arc welding (FCAW) safety
Explain the characteristics of welding current and power sources
Identify and explain the use of FCAW equipment:
  - Spray transfer
  - Globular
  - Short circuiting pulse
Identify and explain the use of FCAW shielding gases and filler metals

Skill:
Demonstrate safety inspections of Flux Cored Arc equipment and accessories.
Demonstrate minor external repairs to Flux Cored Arc equipment and accessories.
Demonstrate set up and operation of FCAW equipment.
Perform welding pad welds on flat plate.
Perform welding pad welds on flat plate – horizontal position.
Perform welding three pass fillet weld tee joint (1F) position.
Perform welding three pass fillet weld tee joint (2F) position.
Perform welding three pass fillet weld tee joint, vertical up, (3F) position.
Perform welding three pass fillet weld tee joint (4F) position.
Perform welding one pass lap joint (2F) position.
Perform welding one pass lap joint (4F) position.
Perform welding “V” bevel groove weld with backing strip (1G) position.
Perform welding “V” bevel groove weld with backing strip (2G) position.
Perform welding “V” bevel groove weld with backing strip, vertical up, (3G) position.
Perform welding “V” bevel groove weld with backing strip (4G) position.
Perform welding open root “V” bevel groove weld (1G) position.
Perform welding open root “V” bevel groove weld (2G) position.
Perform welding open root “V” bevel groove weld, vertical up, (3G) position.
Perform welding open root “V” bevel groove weld (4G) position.
**Remediation:**
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides
- Checklists

**Enrichment:**
- Provide live work/practical assignments for assessments

**Safety:**
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Welding Shield
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use protective clothing and equipment
- Use hand tools in a safe manner
- Use adequate ventilation
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using /operating hand tools
- Use tools and equipment in a professional work like manner according to OSHA standards
- Know and follow the established safety rules at all times

**Assessment:**
- Daily Worksheets
- Tests
- Quizzes
- Rubrics
- Individual projects

**Resources:**
Equipment:

**Safety Equipment:**
- M.S.D.S.
- Forced Draft Ventilation Equipment

**Hand Tools:**
- Wire brushes
- C-clamps
- Pliers/Vice Grips

**Welding Process Equipment/Materials**
- GMAW machine
- Wire feeder
- Gun
- Ground clamp
- Tubular Wire-Filler material
- Gas Cylinder
- Anti-spatter spray
- Carbon steel plate

**Power Equipment**
- 50 ton Hydraulic Shear/punch
- Pedestal grinder

**Portable Power Equipment**
- Hand grinder
- Power wire brushes
Steel Center for Career and Technical Education

Course Name: Welding Technology
Unit Name: Gas Tungsten Arc Welding (GTAW)
Unit Number: PA-800
Hours: 235

Unit Description/Objectives:
Upon completion of this unit the student will be able to identify and demonstrate GTAW safety practices, identify and describe GTAW equipment, demonstrate GTAW set-up, describe GTAW electrode wires and shielding gases. The student will also be able to demonstrate how to produce welds in the Flat (1F, 1G) Horizontal (2F, 2G), Vertical (3F, 3G) and Overhead (4F, 4G), positions on Carbon Steel, Stainless Steel and Aluminum plate.

Tasks:

PA801 - Perform safety inspections of GTAW equipment and accessories.
PA802 - Make minor external repairs to GTAW equipment and accessories.
PA803 - Set up and operate GTAW equipment.
L803a - Perform GTAW beads on carbon steel plate – flat position without filler rod.
L803b - Perform GTAW parallel beads on carbon steel plate – flat position with filler rod.
L803c - Perform GTAW pad welds on carbon steel plate – flat position with filler rod.
PA804 - Make fillet welds, in all positions, on ferrous materials.
L804a - Perform GTAW three pass fillet weld on carbon steel tee joint – flat (1F) position.
L804b - Perform GTAW three pass fillet weld on carbon steel tee joint – horizontal (2F) position.
L804c - Perform GTAW three pass fillet weld on carbon steel tee joint – vertical (3F) position.
L804d - Perform GTAW three pass fillet weld on carbon steel tee joint – overhead (4F) position.
L804e - Perform GTAW one pass lap joint on carbon steel – flat (1F) position.
L804f - Perform GTAW one pass lap joint on carbon steel – horizontal (2F) position.
L804g - Perform GTAW one pass lap joint on carbon steel – vertical (3F) position.
L804h - Perform GTAW one pass lap joint on carbon steel – overhead (4F) position.
PA805 - Pass performance test on ferrous materials.
PA806 - Set up and operate GTAW on nonferrous materials.
L806a - Perform GTAW beads on stainless steel plate – flat position without filler rod.
L806b - Perform GTAW beads on stainless steel plate – flat position with filler rod.
L806c - Perform GTAW parallel beads on stainless steel plate – flat position with filler rod.
L806f - Perform GTAW parallel beads on aluminum plate – flat position with filler rod.
PA807 - Make fillet welds on nonferrous materials.
L807a - Perform GTAW three pass fillet weld on stainless steel tee joint – flat (1F) position.
L807b - Perform GTAW three pass fillet weld on stainless steel tee joint – horizontal (2F) position.
L807c - Perform GTAW three pass fillet weld on stainless steel tee joint – vertical (3F) position.
L807d - Perform GTAW three pass fillet weld on stainless steel tee joint – overhead (4F) position.
L807e - Perform GTAW three pass fillet weld on aluminum tee joint – flat (1F) position.
L807f - Perform GTAW three pass fillet weld on aluminum tee joint – horizontal (2F) position.
L807g - Perform GTAW three pass fillet weld on aluminum tee joint – vertical (3F) position.
L807h - Perform GTAW three pass fillet weld on aluminum tee joint – overhead (4F) position.
L807i - Perform GTAW one pass lap joint on stainless steel – flat (1F) position.
L807j - Perform GTAW one pass lap joint on stainless steel – horizontal (2F) position.
L807k - Perform GTAW one pass lap joint on stainless steel – vertical (3F) position.
L807l - Perform GTAW one pass lap joint on stainless steel – overhead (4F) position.
L807m - Perform GTAW one pass lap joint on aluminum – flat (1F) position.
L807n - Perform GTAW one pass lap joint on aluminum – horizontal (2F) position.
L807o - Perform GTAW one pass lap joint on aluminum – vertical (3F) position.
L807p - Perform GTAW one pass lap joint on aluminum – overhead (4F) position.
PA808 - Pass performance test on nonferrous materials.
Standards / Assessment Anchors

**Focus Standard**
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

**Supporting Standards**
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
3.2.10.B4. Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.

**Connecting Standard**
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

**Supporting Standards**
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

**Instructional Activities:**

**Knowledge:**
- Explain gas tungsten arc welding (GTAW) safety
- Identify and explain the use of GTAW equipment
- Identify and explain the use of GTAW filler metals
- Identify and explain the use of GTAW shielding gases

**Skill:**
- Demonstrate safety inspections of GTAW equipment and accessories.
- Demonstrate minor external repairs to GTAW equipment and accessories.
- Demonstrate set up and operation of GTAW equipment.
- Perform welding beads on carbon steel plate – flat position without filler rod.
- Perform welding parallel beads on carbon steel plate – flat position with filler rod.
- Perform welding pad welds on carbon steel plate – flat position with filler rod.
- Perform welding three pass fillet weld, carbon steel, tee joint (1F) position.
- Perform welding three pass fillet weld, carbon steel, tee joint (2F) position.
- Perform welding three pass fillet weld, carbon steel, tee joint, vertical up, (3F) position.
- Perform welding three pass fillet weld, carbon steel, tee joint, (4F) position.
- Perform welding one pass lap joint, carbon steel, (1F) position.
- Perform welding one pass lap joint, carbon steel, (2F) position.
- Perform welding one pass lap joint, carbon steel, (3F) position.
- Perform welding one pass lap joint, carbon steel, (4F) position.
- Perform welding beads on stainless steel plate, flat position, without filler rod.
- Perform welding beads on stainless steel plate, flat position with filler rod.
- Perform welding parallel beads on stainless steel plate, flat position, with filler rod.
- Perform welding three pass fillet weld on stainless steel tee joint, (1F) position.
- Perform welding three pass fillet weld on stainless steel tee joint, (2F) position.
- Perform welding three pass fillet weld on stainless steel tee joint, vertical up, (3F) position.
- Perform welding three pass fillet weld on stainless steel tee joint, (4F) position.
- Perform welding three pass fillet weld on aluminum tee joint, (1F) position.
- Perform welding three pass fillet weld on aluminum tee joint, (2F) position.
- Perform welding three pass fillet weld on aluminum tee joint, vertical up, (3F) position.
- Perform welding three pass fillet weld on aluminum tee joint, (4F) position.
- Perform welding one pass lap joint on stainless steel, (1F) position.
- Perform welding one pass lap joint on stainless steel, (2F) position.
- Perform welding one pass lap joint on stainless steel, vertical up, (3F) position.
- Perform welding one pass lap joint on stainless steel, (4F) position.
Perform welding one pass lap joint on aluminum, (1F) position.
Perform welding one pass lap joint on aluminum, (2F) position.
Perform welding one pass lap joint on aluminum, (3F) position.
Perform welding one pass lap joint on aluminum, (4F) position.

Remediation:
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides

Enrichment:
- Provide live work/practical assignments for assessments

Safety:
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Welding Shield
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use protective clothing and equipment
- Use hand tools in a safe manner
- Use adequate ventilation when working in enclosed area
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using /operating hand tools
- Use tools and equipment according to OSHA standards
- Know and follow the established safety rules at all times

Assessment:
- Daily Worksheets
- Tests
- Quizzes
- Rubrics
- Individual projects

Resources:

Equipment:
Hand Tools
Wire brushes
File
C-clamps
Pliers/Vice Grips

Welding Process Equipment/Materials
GTAW machine
Torch
Ground clamp
Carbon Steel-Filler material
Stainless steel-Filler material
Aluminum-Filler material
Argon Gas Cylinder
Carbon steel plate
Stainless steel plate
Aluminum plate

Power Equipment
50 ton Hydraulic Shear/punch
Pedestal grinder

Portable Power Equipment
Hand grinder
Power wire brushes
Steel Center for Career and Technical Education

Course Name: Welding Technology  
Unit Name: Manual Oxy-Fuel Gas Cutting (OFC)  
Unit Number: PA-900

Hours: 70

Unit Description/Objectives:

Upon completion of this unit, the student will be able to identify the parts of an oxy-acetylene cutting torch, discuss characteristics of cutting machines, discuss procedures for tip selection and differentiate between good and bad cuts. The student will also be able to properly handle and store cylinders and perform cutting operations, on carbon steel, producing 90°straight cuts, 45°bevel cuts, piercing holes and layout work in accordance with a print.

Tasks:

PA901 - Perform safety inspections of OFC equipment and accessories.
PA902 - Make minor external repairs to OFC equipment and accessories.
PA903 - Set up for manual OFC operations on steel.
PA904 - Operate manual OFC equipment.
PA905 - Perform straight cutting operations on steel.
PA906 - Perform shape cutting operations on steel.
PA907 - Perform bevel cutting operations on steel.
PA908 - Perform piercing operations on steel.

Standards / Assessment Anchors

Focus Standard

3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards

3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

Connecting Standard

CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards

CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems
**Instructional Activities:**

**Knowledge:**
- Identify the parts of an oxy-acetylene cutting torches and equipment
- Differentiate between types of flames
- Discuss procedures for tip selection
- Differentiate between good and bad cuts
- Explain handling and storing cylinders
- Identify safety features of cylinders

**Skill:**
- Demonstrate safety inspections of OFC equipment and accessories.
- Demonstrate minor external repairs to OFC equipment and accessories.
- Demonstrate set up for manual OFC operations on steel.
- Demonstrate operation of manual OFC equipment.
- Demonstrate proper handling and storage of cylinders
- Perform straight cutting operations on steel.
- Perform shape cutting operations on steel.
- Perform bevel cutting operations on steel.
- Perform piercing operations on steel.

**Remediation:**
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides

**Enrichment:**
- Provide live work/practical assignments for assessments

**Safety:**
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Cutting goggles
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use adequate ventilation when working in enclosed area
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using/operating hand tools
- Use tools and equipment according to OSHA standards
- Know and follow the established safety rules at all times

**Assessment:**
- Tests
- Daily Worksheets
- Quizzes
- Rubrics
- Individual projects
Resources:


Equipment:

Safety Equipment:
M.S.D.S.
Forced Draft Ventilation Equipment

Measuring Equipment
Soapstone
Tape measures
Combination Square

Hand Tools:
Chipping Hammer
Wire brushes
Ballpeen hammer
Cold chisel
C-clamps
Pliers/Vice Grips

Welding Process Equipment/Materials
Oxy-fuel cutting outfit
Oxy-fuel equipment wrench
Striker w/flints
Cutting tips
Tip cleaner
Carbon steel plate
Unit Description/Objectives:
Upon completion of this unit, the student will be able to identify the parts of an oxy-acetylene cutting machine, discuss characteristics of cutting machines, discuss procedures for tip selection and differentiate between good and bad cuts. The student will also be able to properly handle and store cylinders and perform cutting operations, on carbon steel, producing 90° straight cuts and bevel cuts, using a self-guided track burner torch.

Tasks:
PA1001 - Perform safety inspections of mechanized OFC equipment and accessories.
PA1002 - Make minor external repairs to mechanized OFC equipment and accessories.
PA1003 - Set up and operate OFC equipment on steel.
PA1004 - Perform straight cutting operations on steel.
PA1005 - Perform bevel cutting operations on steel.

Standards / Assessment Anchors

Focus Standard
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

Connecting Standard
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems
Instructional Activities:

Knowledge:
- Identify the parts of an oxy-acetylene cutting machines
- Discuss characteristics of cutting machines
- Discuss procedures for tip selection
- Differentiate between good and bad cuts
- Differentiate between types of flames
- Explain handling and storing cylinders
- Identify safety features of cylinders

Skill:
- Demonstrate setting up, adjusting, and shutting down oxy-fuel equipment
- Demonstrate proper operation of the oxy-fuel cutting machine
- Demonstrate straight-line cuts
- Demonstrate bevel cuts
- Demonstrate cutting to meet criteria for acceptance

Remediation:
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides

Enrichment:
- Provide live work/practical assignments for assessments

Safety:
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Cutting goggles
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use adequate ventilation when working in enclosed area
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using/operating hand tools
- Use tools and equipment according to OSHA standards
- Know and follow the established safety rules at all times

Assessment:
- Daily Worksheets
- Tests
- Worksheets
- Quizzes
- Rubrics
- Individual projects
Resources:


Equipment:

Safety Equipment:
- M.S.D.S.
- Forced Draft Ventilation Equipment

Measuring Equipment:
- Soapstone
- Tape measures
- Combination Square

Hand Tools:
- Chipping Hammer
- Wire brushes
- Ballpeen hammer
- Cold chisel
- C-clamps
- Pliers/Vice Grips

Welding Process Equipment/Materials:
- Mechanized cutting machine
- Oxy-fuel cutting outfit
- Oxy-fuel equipment wrench
- Striker w/flints
- Cutting tips
- Tip cleaner
- Carbon steel plate
Unit Description/Objectives:
Upon completion of this unit, the student will be able to identify the parts of a Plasma Arc cutting machine, discuss characteristics of Plasma Arc cutting machines, and differentiate between good and bad cuts. The student will also be able to perform safety inspections, make minor external repairs, set up/operate equipment and perform straight and shape cutting operations on ferrous and nonferrous materials.

Tasks:
PA1101 - Perform safety inspections of PAC equipment and accessories.
PA1102 - Make minor external repairs to PAC equipment and accessories.
PA1103 - Set up and operate manual PAC operations on ferrous and nonferrous materials.
PA1104 - Perform shape cutting operations on ferrous and nonferrous materials.

Standards / Assessment Anchors

Focus Standard
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
3.2.10.B4. Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.

Connecting Standard
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

Instructional Activities:

Knowledge:
Describe the plasma arc cutting processes
Describe the differences between plasma arc cutting and other cutting processes
Identify plasma arc cutting equipment
Describe safety practices used for plasma arc cutting
Differentiate between good and bad cuts
Skill:
- Perform safety inspections of PAC equipment
- Prepare and set up plasma arc cutting equipment
- Make minor external repairs to PAC equipment
- Set up and operate manual operations on ferrous and nonferrous materials.
- Demonstrate proper safety practices while cutting
- Perform shape cutting operations on ferrous and nonferrous materials.

Remediation:
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides

Enrichment:
- Provide live work/practical assignments for assessments

Safety:
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Welding helmet w/cutting lenses
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use adequate ventilation when working in enclosed area
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using/operating hand tools
- Use tools and equipment according to OSHA standards
- Know and follow the established safety rules at all times

Assessment:
- Daily Worksheets
- Tests
- Quizzes
- Rubrics
- Individual projects

Resources:


Equipment:

Safety Equipment:
Forced Draft Ventilation Equipment

Measuring Equipment:
Soapstone
Tape measures
Combination Square

Hand Tools:
Chipping Hammer
Wire brushes
Ballpeen hammer
Cold chisel
C-clamps
Pliers/Vice Grips

Welding Process Equipment/Materials:
Plasma arc cutting machine
Compressed air
Cutting tips
Carbon steel plate
Stainless steel plate
Aluminum plate
Steel Center for Career and Technical Education

Course Name: Welding Technology  
Unit Name: Manual Air Carbon Arc Cutting (CAC-A)  
Unit Number: PA-1200  

Hours: 20

Unit Description/Objectives:  
Upon completion of this unit, the student will be able to identify the parts of a Carbon Arc cutting torch (CAC-A), discuss electrode characteristics used for CAC-A and differentiate between gouges, cuts and washes. The student will also be able to perform safety inspections, make minor external repairs, set up/operate equipment and perform gouges, cuts and washes on carbon steel.

Tasks:  
PA1201 - Perform safety inspections of CAC-A equipment and accessories.  
PA1202 - Make minor external repairs to CAC-A equipment and accessories.  
PA1203 - Set up and operate manual CAC-A gouging and cutting operations on steel.  
PA1204 - Perform gouging and scarfing operations, to remove base and weld metal, on steel.

Standards / Assessment Anchors

Focus Standard  
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards  
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
3.2.10.B4. Describe quantitatively the relationships between voltage, current, and resistance to electrical energy and power.

Connecting Standard  
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards  
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems
Instructional Activities:

**Knowledge:**
- Identify the parts of air carbon arc cutting (CAC-A) equipment
- Explain how CAC-A operates
- Differentiate between gouges, cuts and washes

**Skill:**
- Demonstrate safety inspections of CAC-A equipment and accessories
- Demonstrate minor external repairs to CAC-A equipment and accessories
- Prepare the work area and CAC-A equipment for safe operation
- Select and install CAC-A electrodes
- Perform air carbon arc washing on weld metal
- Perform air carbon arc gouging on base metal
- Perform air carbon arc cutting

**Remediation:**
- Review with teacher assistance
- Worksheets
- Reading Comprehension packets
- Retest or alternative assessment
- Study guides

**Enrichment:**
- Provide live work/practical assignments for assessments

**Safety:**
- Student must wear required shop uniform to include:
  - Safety Glasses
  - Fire-resistant (FR) Head Covering
  - FR Jacket
  - Leather gloves
  - Welding helmet w/cutting lenses
  - Leather Work Boots
- Handle material in a safe and work like manner
- Use adequate ventilation when working in enclosed area
- Follow manufacturer’s directions when using any product, tool, equipment, etc.
- Use proper safety precautions when using/operating hand tools
- Use tools and equipment according to OSHA standards
- Know and follow the established safety rules at all times

**Assessment:**
- Daily Worksheets
- Tests
- Quizzes
- Rubrics
- Individual projects
Resources:


Equipment:

Safety Equipment:
Forced Draft Ventilation Equipment

Measuring Equipment:
Soapstone
Tape measures
Combination Square

Hand Tools:
Chipping Hammer
Wire brushes
Ballpeen hammer
C-clamps
Pliers/Vice Grips

Welding Process Equipment/Materials:
Shielded metal arc welding machine
CAC-A torch
Compressed air
Carbon electrodes
Carbon steel plate
Unit Description/Objectives:
Upon completion of this unit the student will be able to identify and differentiate between brazing and soldering and explain procedures and techniques used in this process. The student will also be able to demonstrate how to brazing and soldering using the oxy-fuel process.

Tasks:
PA1301 - Set up and operate oxy-fuel brazing and soldering equipment.
PA1302 - Perform brazing and soldering operations.
L1302a - OxyFuel brazing-Flat pad/surfacing using coated bronze filler rods
L1302b - OxyFuel brazing, 1G Butt Joint using coated bronze filler rods
L1302c - OxyFuel brazing, 1F Lap joint using coated bronze filler rods
L1302d - OxyFuel brazing, 2F Lap joint using coated bronze filler rods
L1302e - OxyFuel soldering, 2F Lap joint using silver solder rods

Standards / Assessment Anchors

Focus Standard
3.4.12. A3 Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM).

Supporting Standards
3.2.P.B3 Analyze the factors that influence convection, conduction, and radiation between objects or regions that are at different temperatures.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems

Connecting Standard
CC.3.5.11-12. C. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Supporting Standards
CC.3.5.11-12. B Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms.
CC.2.1. HS.F.4 Use units as a way to understand problems and to guide the solution of multi-step problems
Instructional Activities:

Knowledge:
Differentiate between welding, brazing and soldering
Define brazing
Define soldering
Define capillary action with regards to soldering

Skill:
Demonstrate set up and operate oxy-fuel brazing and soldering equipment
Perform brazing in a groove on a butt joint
Perform brazing in a lap and tee joint
Perform soldering in a lap joint

Remediation:
Review with teacher assistance
Worksheets
Reading Comprehension packets
Retest or alternative assessment
Study guides

Enrichment:
Provide live work/practical assignments for assessments

Safety:
Student must wear required shop uniform to include:
Safety Glasses
Fire-resistant (FR) Head Covering
FR Jacket
Leather gloves
Brazing/soldering goggles
Leather Work Boots
Handle material in a safe and work like manner
Use adequate ventilation when working in enclosed area
Follow manufacturer’s directions when using any product, tool, equipment, etc.
Use proper safety precautions when using/operating hand tools
Use tools and equipment according to OSHA standards
Know and follow the established safety rules at all times

Assessment:
Daily Worksheets
Tests
Quizzes
Rubrics
Individual projects

Resources:


Equipment:

**Safety Equipment:**
M.S.D.S.
Forced Draft Ventilation Equipment

**Measuring Equipment**
Soapstone
Tape measures
Combination Square

**Hand Tools:**
Chipping Hammer
Wire brushes
Ballpeen hammer
Cold chisel
C-clamps
Pliers/Vice Grips

**Welding Process Equipment/Materials:**
Oxy-fuel brazing outfit
Oxy-fuel equipment wrench
Striker w/flints
Brazing/soldering tips
Tip cleaner
Carbon steel plate