Steel Center for Career and Technical Education

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).

Standards / Assessment Anchors

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

Equipment:

None required for this unit

Steel Center for Career and Technical Education

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

Equipment:

None required for this unit

Steel Center for Career and Technical Education

Course Name: Welding Technology

Unit Name: Visual Examination, Inspection and Testing

Unit Number: PA-400

Hours: 20

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

Equipment:

Hi-low gages
Fillet gages

Steel Center for Career and Technical Education

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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

Steel Center for Career and Technical Education

Course Name: Welding Technology

Unit Name: Gas Metal Arc Welding (GMAW)

Unit Number: PA-600

Hours: 210

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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

Steel Center for Career and Technical Education

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 grove 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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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

Steel Center for Career and Technical Education

Course Name: Welding Technology
Unit Name: Mechanized Oxy-Fuel Gas Cutting (OFC)
Unit Number: PA-1000

Hours: 20

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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

Steel Center for Career and Technical Education

Course Name: Welding Technology
Unit Name: Manual Plasma Arc Cutting (PAC)
Unit Number: PA-1100

Hours: 20

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Annotated Instructor's Guide. Pearson Prentice Hall, Upper Saddle River, NJ.

National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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:

National Center for Construction Education and Research (NCCER). (2015). Welding Levels, I and II, Student. Pearson Prentice Hall, Upper Saddle River, NJ.

Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Student. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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

Steel Center for Career and Technical Education

Course Name: Welding Technology
Unit Name: Brazing and Soldering
Unit Number: PA-1300

Hours: 20

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:

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National Center for Construction Education and Research (NCCER). (2015). Welding Levels II, Annotated Instructor's Guide. National Center for Construction Education and Research Welding. Pearson Prentice Hall, Upper Saddle River, NJ.

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