

WELDING III

JANUARY 2007

WELDING II

NEW JERSEY CORE CURRICULA CONTENT STANDARDS

Throughout this vocational/technical program the NJ Core Curricula Content Standards for Career Education and Consumer, Family and Life Skills are regularly reinforced. This includes addressing the standards in throughout all phases of the course outline. The specific standards addressed and the goals for their application include, but are not necessarily limited to, the following as defined by the State of NJ, Department of Education.

Career Education and Consumer, Family and Life Skills

STANDARD 9.1 (CAREER AND TECHNICAL EDUCATION) ALL STUDENTS WILL DEVELOP CAREER AWARENESS AND PLANNING, EMPLOYABILITY SKILLS, AND FOUNDATIONAL KNOWLEDGE NECESSARY FOR SUCCESS IN THE WORKPLACE.

All students will explore career opportunities and make informed choices based on aptitudes and interests. Students will identify and pursue career goals, apply communications skills in work-relevant situations, demonstrate the ability to combine ideas or information in new ways, make connections between unrelated ideas, organize and present information, and allocate financial and other resources efficiently and effectively. Students will identify and use various print and non-print resources in the home, school, and community to seek and plan for employment. They will be able to use the job application process, including resumes, forms, and interviews.

Building upon knowledge and skills gained in preceding grades, by the end of **Grade 12**, students will:

A. Career Awareness/Preparation

1. Re-evaluate personal interests, abilities, and skills through various measures including self assessments.
2. Evaluate academic and career skills needed in various career clusters.
3. Analyze factors that can impact an individual's career.
4. Review and update their career plan and include the plan in a portfolio.
5. Research current advances in technology that apply to a selected occupational career cluster.

B. Employability Skills

1. Assess personal qualities that are needed to obtain and retain a job related to career clusters.
2. Communicate and comprehend written and verbal thoughts, ideas, directions, and information relative to educational and occupational settings.
3. Select and utilize appropriate technology in the design and implementation of teacher-approved projects relevant to occupations and/or higher educational settings.
4. Evaluate the following academic and career skills as they relate to home, school, community, and employment:
 - Communication
 - Punctuality
 - Time management
 - Organization
 - Decision making
 - Goal setting
 - Resources allocation
 - Fair and equitable competition
 - Safety
 - Employment application skills
 - Teamwork
5. Demonstrate teamwork and leadership skills that include student participation in real world applications of career and technical education skills.

All students electing further study in career and technical education will also:

1. Participate in a structured learning experience that demonstrates interpersonal communication, teamwork, and leadership skills.
2. Participate in simulated industry assessments, when and where appropriate.
3. Prepare industry-specific technical reports/projects that incorporate graphic aids, when and where appropriate.
4. Demonstrate occupational health and safety skills related to industry-specific activities.

Career Education and Consumer, Family and Life Skills

STANDARD 9.2 (CONSUMER, FAMILY, AND LIFE SKILLS) ALL STUDENTS WILL DEMONSTRATE CRITICAL LIFE SKILLS IN ORDER TO BE FUNCTIONAL MEMBERS OF SOCIETY.

All students will develop original thoughts and ideas, think creatively, develop habits of inquiry, and take intellectual and performance risks. They will recognize problems, devise a variety of ways to solve these problems, analyze the potential advantages and disadvantages of each alternative, and evaluate

the effectiveness of the method ultimately selected. Students will understand the components of financial education and make economic choices. Students will demonstrate self-awareness and the ability to respond constructively to criticism and potential conflict. In addition, students will work collaboratively with a variety of groups and demonstrate the essential components of character development and ethics, including trustworthiness, responsibility, respect, fairness, caring, and citizenship. Students apply principles of resource management and skills that promote personal and professional well-being. Wellness, nutrition, child development, and human relationships are an important part of consumer, family, and life skills. However, wellness, nutrition, and human relationship cumulative progress indicators are not listed here as it would duplicate those in Comprehensive Health and Physical Education Standards.

Building upon knowledge and skills gained in preceding grades, by the end of **Grade 12**, students will:

A. Critical Thinking

1. Apply communications and data analysis to the problem-solving and decision making processes in a variety of life situations.
2. Describe and apply constructive responses to criticism.
3. Apply the use of symbols, pictures, graphs, objects, and other visual information to a selected project in academic and/or occupational settings.
4. Recognize bias, vested interest, stereotyping, and the manipulation and misuse of information while formulating solutions to problems that interfere with attaining goals.
5. Apply knowledge and skills needed to use various means of transportation within a community.

B. Self-Management

1. Revise and update the personal growth plan to address multiple life roles.
2. Apply project planning and management skills in academic and/or occupational settings.
3. Compare and contrast methods for maximizing personal productivity.

C. Interpersonal Communication

1. Model interpersonal and effective conflict resolution skills.
2. Communicate effectively in a variety of settings with a diverse group of people.

D. Character Development and Ethics

1. Analyze how character influences work performance.
2. Identify and research privileges and duties of citizens in a democratic society.
3. Discuss consequences and sanctions when on-the-job rules and laws are not followed.
4. Compare and contrast a professional code of ethics or code of conduct from various work fields and discuss similarities and differences.
5. Apply a professional code of ethics to a workplace problem or issue.

E. Consumer and Personal Finance

1. Analyze factors that influence gross and net income.
2. Design, implement, and critique a personal financial plan.
3. Discuss how to obtain and maintain credit.
4. Prepare and use skills for budget preparation, making predictions about income and expenditures, income tax preparation, and adjusting spending or expectations based on analysis.
5. Use comparative shopping techniques for the acquisition of goods and services.
6. Analyze the impact of advertising, peer pressure, and living arrangements on personal purchasing decisions.
7. Evaluate the actions a consumer might take in response to excess debt and personal financial status.
8. Analyze the interrelationships between the economic system and consumer actions in a chosen career cluster.

F. Safety

1. Engage in an informed discussion about rules and laws designed to promote safety and health.

2. Describe and demonstrate basic first aid and safety procedures.
3. Analyze the occurrence of workplace hazards.
4. Practice the safe use of tools and equipment.
5. Implement safety procedures in the classroom and workplace, where appropriate.
6. Discuss motor vehicle safety, including but not limited to, New Jersey motor vehicle laws and regulations, methods of defensive driving, and the importance of personal responsibility on public roads/streets.

I. COURSE DESCRIPTION

Welding II is an intermediate welding course in which the content of each of the American Welding Society Entry Level Welder core curriculum modules are developed in depth. Units of instruction include advanced hands on training in gas tungsten arc welding, flux-cored arc welding, gas metal arc welding, shielded metal arc welding, oxyfuel cutting, plasma arc and air carbon arc cutting. Each unit is presented as a core program providing a comprehensive content coverage of out of position welding techniques, equipment operation and maintenance, filler materials, base metal joint designs, weld configuration, weld inspection and testing.

Weld quality assurance and quality control curriculum is introduced that relates to the inspection and evaluation of the students weldments, the identification and classification of discontinuities that determine weld acceptability by AWS certification standards. Metallurgy and the welding characteristics of metals are incorporated into lessons providing a complete understanding of each welding process and the metallurgic effects of welding arc heat input on the base metal.

Students will demonstrate the ability to interpret engineering drawings by using blueprints in the fabrication of projects and practice weldments for welding technique-training exercises. Welding symbol interpretation is instructed as an integral part of the communication process providing visualization of the intended weld data needed to produce dimensionally accurate quality welds as denoted by the designer.

Students will develop an in depth understanding of the technical information knowledge requirements for the AWS Entry Level Welder certification written test. Students will strive to achieve the welding technique skill levels necessary to accomplish each of the AWS Workmanship Performance Qualification projects required to obtain the Entry Level Welder certification.

II. COURSE OBJECTIVE/OUTLINE

A. HEALTH AND SAFETY PRACTICES AND PROCEDURES

The student will be able to:

1. Identify, explain and report the causes of accidents.
2. Explain the limits of First Aid and administer First Aid procedures.
3. Demonstrate the correct methods of lifting and material handling.
4. Demonstrate the safe and proper use of all shop personal safety equipment.
5. Demonstrate the emergency evacuation procedures.
6. Demonstrate the safe and proper procedures for the use of fire fighting equipment.
7. List the ruled and regulations of fire prevention.
8. Demonstrate proper housekeeping procedures for storage, cleanliness and maintenance.
9. Identify safety zones by color-coding, tags, signs and labels.
10. Identify electrical shock hazards and demonstrate the proper use of electrical emergency stop devices.
11. Demonstrate the safe and proper use of general hand tools and tools of the welding trade.
12. Demonstrate the safe and proper use of power tools.
13. Demonstrate the safe and proper use of welding electrical power supplies and equipment.
14. Explain the methods of prevention of arc flashing and arc burn.
15. Demonstrate the safe and proper handling of compressed gas cylinders.
16. Demonstrate the safe and proper use of oxygen and acetylene cylinders, torches and equipment.

B. RELATED SKILLS AND KNOWLEDGE

The student will be able to:

1. Demonstrate the use of book mechanics including tables, index, glossary, appendix and reference sections.
2. Enter appropriate information and accurately transfer information to forms.
3. Locate and develop knowledge of employment opportunities in the welding industry through career information research, lessons, presentations, multi-media events and field trips.

C. BLUEPRINT INTERPRETATION

The student will be able to:

1. Demonstrate the ability to use conversion factors to convert customary US system standard units of measurement to SI metric equivalents.
2. Identify the standard lines used to develop a blueprint and explain the intended purpose of each type of line.

3. Locate the bill of materials and identify parts numbers, quantities and verbal descriptions of each component.
4. Identify the location and name of each view in an orthographic projection engineering drawing.
5. Explain the dimensional points of reference using surface, edge and centerline relationships for part location and alignment.
6. Explain the use and need for auxiliary views and revolved sectional views in an orthographic engineering drawing.
7. Demonstrate knowledge of the mathematics involved in the use of drawing scale to reduce or enlarge drawing views as it relates to the true dimensions of a part illustrated on the blueprint.
8. Explain the types and specific limits of dimensional tolerances and material stock allowances used in engineering drawings.
9. Accurately interpret specifications and locate the dimensions of each part on the drawing to develop a complete material cutting list required to accomplish preparation of AWS workmanship performance qualification test weldments.

D. WELDING SYMBOL INTERPRETATION

The student will be able to:

1. Demonstrate a thorough understanding of the American Welding Society Welding symbol system delineated in the latest edition of AWS A2.4 Symbols for Welding and Nondestructive Testing.
2. Identify and explain all the components and information illustrated on fillet, groove, surfacing and flange welding symbols.
3. Identify and explain all the components and information illustrated on plug, slot, spot and seam welding symbols.
4. Identify and explain all the components and information illustrated on combination welding symbols.

E. WELD QUALITY ASSURANCE AND QUALITY CONTROL

The student will be able to:

1. Explain the need for weld inspection to establish the quality of welds as related to weld uniformity in mechanical, metallurgical and physical characteristics.
2. Develop specific knowledge about welding codes, standards and issuing agencies.
3. Identify and define the various types of weld discontinuities and defects.
4. Identify and explain the common causes of weld discontinuities relate to shape, size and contour.
5. Identify and explain the common causes of discontinuities related to internal inconsistencies and weld metal irregularities.
6. Identify and explain the common causes of discontinuities related to weld and base metal properties.

F. WELDING METALLURGY

The student will be able to:

1. Explain the various methods of base metal identification including appearance, chemical, chisel, file, magnet, sound and spark test.
2. Explain the mechanical and physical properties of metals and their characteristics.
3. Explain the mechanical and dynamic strengths of metals and their characteristics.
4. Describe the identification and classification systems for carbon steels, alloy steels, iron, stainless steel, aluminum and other nonferrous metals.
5. Describe the various methods and equipment used to test the mechanical properties of metals.
6. Discuss the metallurgic effects of residual stresses and distortion caused by welding processes.
7. Discuss the various precautions, prevention and post welding techniques used to counteract and correct the effects of residual stresses and distortion caused by welding processes.

G. MANUAL AIR CARBON ARC CUTTING

The student will be able to:

1. Demonstrate the safe and proper procedure for assembly, set up and safety testing of manual Air Carbon Arc Cutting equipment.
2. Demonstrate the safe and proper handling of compressed air supplies for CAC-A cutting.
3. Recall, relate and communicate CAC-A terminology and definitions.
4. Explain the fundamental principles and process variables of CAC-A operation.
5. Identify CAC-A equipment components and the specific functions.
6. Identify CAC-A electrodes and select electrodes for various applications.
7. Demonstrate the safe and proper operation of the CAC-A cutting torch.
8. Demonstrate the correct technique for starting and maintaining a CAC-A cutting torch arc on carbon steel.
9. Demonstrate the correct techniques for performing 1G and 2G position scarfs and gouges on carbon steel.

H. OXYFUEL CUTTING

The student will be able to:

1. Perform equipment set up for manual OFC torch operations on carbon steel.
2. Demonstrate the correct technique for straight line, square edge, manual OFC cuts on carbon steel in the 3G and 4G positions.
3. Demonstrate the correct technique for beveled, manual OFC cuts on carbon steel in the 3G and 4G positions.

4. Demonstrate the correct technique for radius and irregular shape, square edge, manual OFC cuts on carbon steel in the 3G and 4G positions.
5. Perform the manual OFC cutting techniques required to prepare the parts for each workmanship performance qualification test sample weldment, that are of acceptable flatness, roughness, angularity and within dimensional tolerance as per AWS QC10 and AWS C4.1.

I. PLASMA ARC CUTTING/PLASMA CAM CUTTING

The student will be able to:

1. Demonstrate the safe and proper procedures for equipment setup and operation of the Plasma Computer Assisted Machine Cutting process.
2. Use of plasma cam cad design program to create a cut path design.
3. Perform the plasma cam initializing command sequence and cutting command operation to machine cut a path design.
4. Perform the manual PAC, straight and curved, square edge, cutting techniques required to prepare the parts for each workmanship performance qualification test weldment, that are of acceptable roughness, angularity and within dimensional tolerance as per AWS QC10 and AWS C5.2.

J. GAS TUNGSTEN ARC WELDING

The student will be able to:

1. Perform fillet welds in the 3F and 4F positions on carbon steel.
2. Perform groove welds in the 3G and 4G positions on carbon steel.
3. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the carbon steel workmanship performance qualification test weldment.
4. Perform fillet welds in the 3F and 4F positions on stainless steel.
5. Perform groove welds in the 3G and 4G positions on stainless steel.
6. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the stainless steel workmanship performance qualification test weldment.
7. Perform fillet welds in the 3F and 4F positions on aluminum.
8. Perform groove welds in the 3G and 4G positions on aluminum.
9. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the aluminum workmanship performance qualification test weldment.

K. SHIELDED METAL ARC WELDING

The student will be able to:

1. Perform fillet welds in the 3F and 4F positions with E6010 electrodes using single and multiple pass welds.
2. Perform fillet welds in the 3F and 4F positions with E7018 electrodes using single and multiple pass welds.

3. Perform groove welds in the 3G and 4G positions with E6010 electrodes using single and multiple pass welds.
4. Perform groove welds in the 3G and 4G positions with E7018 electrodes using single and multiple pass welds.
5. Perform test plate preparation and fabrication to accomplish assembly of the carbon steel workmanship performance qualification test weldments.
6. Accurately follow the AWS SMAW welding procedure specification and apply the correct welding techniques to accomplish the workmanship performance qualification test weldments for the 2G and 3G positions.
7. Perform bend test specimen preparations of the 2G and 3G workmanship performance qualification test weldments.

L. GAS METAL ARC WELDING/GMAW SPRAY

The student will be able to:

1. Perform fillet welds in the 3F and 4F positions using single and multiple pass welds.
2. Perform groove welds in the 3G and 4G positions using single and multiple pass welds.
3. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the GMAW short circuit transfer workmanship performance qualification test weldment on carbon steel.
4. Perform fillet welds in the 1F and 2F positions using spray transfer on single and multiple pass welds.
5. Perform groove welds in the 1G position using spray transfer on single and multiple pass welds.
6. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the GMAW spray transfer workmanship performance qualification test weldment on carbon steel.

M. FLUX CORED ARC WELDING/FCAW with GAS

The student will be able to:

1. Perform fillet welds in the 3F and 4F positions using the self shielded FCAW process on single and multiple pass welds.
2. Perform groove welds in the 3G and 4G positions using self shielded FCAW process on single and multiple pass welds.
3. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the self shielded FCAW workmanship performance qualification test weldment on carbon steel.
4. Perform fillet welds in the 3F and 4F positions using the gas shielded FCAW process on single and multiple pass welds.
5. Perform groove welds in the 3G and 4G positions using the gas shielded FCAW process on single and multiple pass welds.
6. Demonstrate the correct fabrication procedures and apply the correct welding techniques to accomplish the gas shielded FCAW process

workmanship performance qualification test weldment on carbon steel.

III. TEXTBOOKS AND INSTRUCTIONAL MATERIALS

American Welding Society, S.E.N.S.E., Curriculum Guide for the Training of Welding Personnel: Level 1-Entry Level Welder, AWS EG2.0:2006, reference publications:

- ANSI Z39.1 Safety in Welding , Cutting and Allied Processes.
- AWS A2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination.
- AWS A3.0 Standard Welding Terms and Definitions.
- AWS B1.11 Guide for the Visual Inspection of Welds.
- AWS C4.2 Recommended Practices for Safe Oxyfuel Gas Cutting Torch Operation.
- AWS C5.2 Recommended Practices for Plasma Arc Cutting and Gouging.
- AWS C5.3 Recommended Practices for Air Carbon Arc Gouging and Cutting.
- AWS C5.5 Recommended Practices for Gas Tungsten Arc Welding.
- AWS C5.6 Recommended Practices for Gas Metal Arc Welding.
- WHB-2.X Welding Handbook Volume Two, Welding Processes-Part 1.
- WHB-3.X Welding Handbook Volume Three, Welding Processes-Part 2.
- WHB-4.X Welding Handbook Volume Four, Materials and Applications-Part 1.
- WHB-5.X Welding Handbook Volume Five, Materials and Applications-Part 2.

Hobart Institute of Welding Technology Curriculum Video Training Modules:

- Blueprint Reading for Welders and Fitters.
- Weld Quality Assurance and Quality Control Section 4 Discontinuities and Defects.
- Symbols for Welding.
- Shielded Metal Arc Welding Basic.
- Gas Metal Arc Welding Basic.
- Flux-Cored Arc Welding.
- Gas Tungsten Arc Welding Basic.

Instruction Manual for the Plasma Cam Cutting System, Plasma Cam Inc., Colorado City, CO, 2002.

Ornamental Iron idea and design book, Marshall Bulle, Rye, Colorado, 2002.

IV. INSTRUCTIONAL STRATEGIES

In order to meet the individual needs of out students, differentiated instruction is utilized in every class. This involves the use of a variety of instructional strategies, including but not necessarily limited to: readings and exercises from the approved text(s) and related supplemental materials; hands-on practical projects; cooperative group activities; teacher generated handouts; lecture in conjunction with class discussion and notes; debates; role

playing activities; oral and written reports; simulations; multimedia presentations; related field trips; related technology based projects, Internet and ITV presentations and conferences.

V. EVALUATION

Students will be evaluated objectively in accordance with state and local guidelines. It is our goal to afford students every opportunity to succeed and to include both formative and summative methods of assessment. A wide variety of evaluation methods will be utilized in order to accommodate the multiple intelligences of our students, and incorporate the variety of learning styles and diversification of instructional methods. Evaluation methods will include, but are not necessarily limited to, the following:

1. Tests and Quizzes (questioning strategies include essay, multiple choice, true and false, matching, fill in the blank, and short answer);
2. Projects;
3. Classroom activities;
4. Research;
5. Reports;
6. Notebook maintenance;
7. Class participation;
8. Rubrics;
9. Portfolios;
10. Teacher observation.
11. Entry Level Welder Closed Book Examination (see AWS EG2.0:2006).
12. Entry Level Welder Workmanship Performance Qualification sample weldments (see AWS EG2.0:2006-AWS EDU Drawing No. AWS-1 through 5, AWS QC10).
13. Entry Level Welder Standard Performance Qualification, visual examination and bend test criteria (see AWS EG2.0:2006-AWS EDU Drawing No. AWS-6, AWS QC10).

VI. SCOPE AND SEQUENCE CHART

Key I=Introduced

D=Developed in Depth

R=Reinforced

SKILL TO BE LEARNED	10	11	12
<u>Gain knowledge of welding shop safety practices.</u>		IDR	
<u>Gain an understanding of employment opportunities in the welding industry.</u>		IDR	
<u>Gain an understanding of the construction and interpretation of detailed engineering drawings.</u>		IDR	
<u>Gain an understanding of the AWS welding symbol system.</u>		IDR	
<u>Gain an understanding of welding quality assurance and quality control procedures and standards.</u>		IDR	
<u>Gain an understanding of welding metallurgy and the welding characteristics of metals.</u>		IDR	
<u>Gain an understanding of air carbon arc cutting equipment.</u>		IDR	
<u>Demonstrate skills performing manual air carbon arc cutting techniques.</u>		IDR	
<u>Demonstrate skills performing manual oxyacetylene cutting techniques.</u>		IDR	
<u>Demonstrate skills performing manual plasma arc cutting techniques.</u>		IDR	
<u>Gain an understanding of plasma computer assisted machine cutting equipment and computer assisted drafting software.</u>		IDR	
<u>Demonstrate skills performing plasma computer assisted machine cutting techniques.</u>		IDR	
<u>Demonstrate skills performing gas tungsten arc welding techniques.</u>		IDR	
<u>Demonstrate skills performing shielded metal arc welding techniques.</u>		IDR	
<u>Demonstrate skills performing gas metal arc welding techniques.</u>		IDR	
<u>Demonstrate skills performing self shielded flux cored arc welding techniques.</u>		IDR	

PASSAIC COUNTY TECHNICAL INSTITUTE

X. STUDENT HANDOUT

WELDING II

COURSE OVERVIEW

Welding II is an intermediate welding course in which the content of each of the American Welding Society Entry Level Welder core curriculum modules are developed in depth. Units of instruction include advanced hands on training in gas tungsten arc welding, flux-cored arc welding, gas metal arc welding, shielded metal arc welding, oxyfuel cutting, plasma arc and air carbon arc cutting. Each unit is presented as a core program providing a comprehensive content coverage of out of position welding techniques, equipment operation and maintenance, filler materials, base metal joint designs, weld configuration, weld inspection and testing.

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strive to achieve the welding technique skill level necessary to accomplish each of the AWS Workmanship Performance Qualification projects required to obtain the Entry Level Welder certification.

PROFICIENCIES-Upon successful completion of the requirements of this course, the student will be able to:

- A. Demonstrate knowledge of welding shop health and safety practices.
- B. Apply knowledge of employment opportunities in the welding industry.
- C. Demonstrate an attitude of quality, accuracy and pride in workmanship.
- D. Demonstrate proper use and maintenance of all shop tools and equipment.
- E. Accurately interpret engineering drawings.
- F. Demonstrate knowledge of metal identification and welding metallurgy.
- G. Demonstrate entry level welding skills in the GTAW, GMAW, SMAW, FCAW welding processes and the OFC-A, PAC, ACA-C cutting processes.
- H. Apply knowledge of welding certification standards and testing procedures.