Maryland CTE Programs of Study

Welding II (2025)

GENERAL REQUIREMENTS. This course is recommended for students in Grades 10-12. 1

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INTRODUCTION 2

A Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. 2.A

B The Construction Career Cluster prepares students for careers in designing, planning, and building sustainable infrastructure. This field includes architects, engineers, construction managers, and skilled trades professionals. 2.B

C The Welding Program of Study is a comprehensive three-course welding program prepares students for entry-level careers in the welding industry through progressive skill development and industry-recognized certifications. Students advance from basic construction and safety fundamentals through advanced welding techniques, learning essential skills such as producing multi-position welds, interpreting blueprints, operating various welding equipment, performing quality inspections, and executing complex pipe-to-plate connections. Upon completion, graduates are prepared to earn four valuable industry credentials: OSHA 30 Construction certification, NCCER Core, NCCER Welding Level 1, NCCER Welding Level 2, and AWS Sense Level I qualifying them for immediate employment in construction, manufacturing, and fabrication industries. 2.C

D The Welding II course builds upon foundational skills to develop expertise in complex welding applications. Students master GMAW/FCAW in all positions, learn GTAW (Gas Tungsten Arc Welding) techniques, and perform advanced SMAW operations including open-root welds and pipe-to-plate connections. The curriculum covers metallurgy, pre/post-heat treatments, and comprehensive weld inspection methods including destructive and non-destructive testing. Students interpret advanced welding symbols, create detailed welding plans, and perform welds that meet rigorous AWS standards for various industrial applications. 2.D

E Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational nterviews or job shadowing relevant to the program of study. 2.E

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F **Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.** 2.F

KNOWLEDGE AND SKILLS 3

A **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:** 3.A

1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills. 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5
6. Implement safety procedures, including proper handling of hardware and following OSHA guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the construction field, following applicable laws and best practices for safety. 3.A.7
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting. 3.A.8

B **The student identifies various career pathways in the Welding field. The student is expected to:** 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles that require welding related skills. 3.B.1
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations. 3.B.2
3. Demonstrate effective interview skills for roles in the Welding field. 3.B.3

C **The student identifies the issues associated with Welding related hazards found on a jobsite. The student is expected to:** 3.C

1. Demonstrate safe working procedures in a construction environment. 3.C.1
2. Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job. 3.C.2
3. Identify Welding related hazards and how to avoid or minimize them in the workplace. 3.C.3
4. Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection. 3.C.4

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D **The student integrates core academic skills into Welding construction practices. The student is expected to:** 3.D

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards. 3.D.1
2. Apply advanced geometry and trigonometry for complex joint configurations and pipe welding. They use algebraic formulas for heat input calculations, statistical analysis for quality control, and advanced measurement techniques for weld testing and inspection. Mathematical skills extend to thermal calculations for pre/post-heat treatments. 3.D.2
3. Study advanced metallurgy including crystalline structures and phase transformations, complex electrical theory for GTAW operations, and advanced thermal dynamics for heat treatment processes. They apply principles of plasma physics, advanced gas dynamics for shielding gas mixtures, and materials science concepts for understanding metal behavior under various conditions. 3.D.3

E **The student demonstrates advanced interpretation of welding symbols and drawings. The student is expected to:** 3.E

1. Interpret complex welding symbols including supplementary symbols and specifications. 3.E.1
2. Interpret fit-up/layout drawings to determine specifications and measurements. 3.E.2
3. Create detailed welding plans based on blueprint specifications. 3.E.3
4. Calculate material requirements from welding drawings. 3.E.4
5. Verify compliance between completed welds and blueprint requirements. 3.E.5

F **The student analyzes metal properties and their effects on welding. The student is expected to:** 3.F

1. Identify various metals using physical and mechanical testing methods. 3.F.1
2. Analyze how metal properties affect weldability. 3.F.2
3. Evaluate the effects of heat input on metal properties. 3.F.3
4. Select appropriate welding procedures based on material characteristics. 3.F.4

G **The student demonstrates knowledge of thermal treatment procedures. The student is expected to:** 3.G

1. Calculate appropriate pre-heat temperatures based on material specifications. 3.G.1
2. Execute proper pre-heating procedures using various heating methods. 3.G.2
3. Monitor and maintain interpass temperatures during welding. 3.G.3
4. Implement appropriate post-weld heat treatment procedures. 3.G.4

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H **The student demonstrates mastery of wire-fed welding processes. The student is expected to:** 3.H

1. Perform GMAW welds in all positions meeting AWS standards, safely. 3.H.1
2. Perform FCAW welds in all positions meeting AWS standards, safely. 3.H.2
3. Select optimal parameters for different material types and thicknesses. 3.H.3
4. Demonstrate proper techniques for welding various joint configurations. 3.H.4

I The student demonstrates mastery of SMAW applications. The student is expected to: 3.I

1. Perform multi-pass welds in all positions meeting AWS standards, safely. 3.I.1
2. Perform open-root V-groove welds in all positions with backing bar, safely. 3.I.2
3. Implement proper techniques for welding pipe to plate, safely. 3.I.3
4. Apply hardfacing and buildup procedures to specification, safely. 3.I.4

J The student demonstrates proficiency with gas tungsten arc welding fundamentals. The student is expected to: 3.J

1. Configure GTAW equipment for various welding applications. 3.J.1
2. Explain the appropriate use scenarios for foot pedal vs. thumb operated GTAW machines and benefits of each. 3.J.2
3. Select appropriate tungsten electrodes based on material and current type. 3.J.3
4. Determine proper shielding gas mixtures for different materials. 3.J.4
5. Perform equipment maintenance and troubleshooting procedures. 3.J.5

K The student demonstrates proficiency in GTAW plate welding techniques. The student is expected to: 3.K

1. Perform GTAW welds on plate in all positions meeting AWS standards, safely. 3.K.1
2. Demonstrate proper torch manipulation techniques for various joint designs, safely. 3.K.2
3. Control heat input to prevent material distortion. 3.K.3
4. Evaluate and correct GTAW weld defects. 3.K.4

L The student performs comprehensive weld quality evaluation. The student is expected to: 3.L

1. Conduct destructive testing procedures according to industry standards. 3.L.1
2. Perform non-destructive testing techniques to evaluate weld quality. 3.L.2
3. Interpret testing results to determine weld acceptability. 3.L.3
4. Document inspection findings according to industry requirements. The following standards are specifically for American Welding Society Sense Level I certification: 3.L.4

M The student demonstrates GTAW fundamentals and plate welding. The student is expected to: 3.M

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1. Configure GTAW equipment; select tungsten type/size, shielding gas, and parameters for carbon steel. 3.M.1
2. Deposit GTAW fillet welds (1F/2F) and basic groove welds on plate meeting SENSE acceptance criteria; evaluate arc length, travel speed, and heat input. (SENSE Module 7.) 3.M.2

N The student advances SMAW/GMAW/FCAW proficiency. The student is expected to: 3.N

1. Produce multi-pass fillet and groove welds in additional positions as facility/equipment allow, meeting AWS acceptance criteria. 3.N.1
2. Optimize parameters using WFS, voltage, amperage, CTWD, and travel angle adjustments; document WPS-like settings derived from SENSE technique sheets. (EG2.0 technique sheets for Level I workmanship/performance.) 3.N.2

O The student completes AWS SENSE Level I assessments and documentation. The student is expected to: 3.O

1. Pass SENSE Level I knowledge exams for all completed modules. 3.O.1
2. Pass required workmanship/performance tests for Level I (per QC10 Clauses 6–7) and record results (Clauses 9–10). 3.O.2
3. Submit required records for inclusion in the AWS SENSE Certificate Database and issuance of the Level I—Entry Welder training certificate (full or partial, as applicable). 3.O.3