Maryland CTE Programs of Study

Welding I (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, and NCCER Welding Level 2, qualifying them for immediate employment in construction, manufacturing, and fabrication industries.** 2.C

D **This foundational welding course introduces students to essential welding processes and safety protocols. Students develop proficiency in oxyfuel cutting, SMAW (Shielded Metal Arc Welding), and basic GMAW/FCAW (Gas Metal/Flux Cored Arc Welding) operations. The curriculum emphasizes proper equipment setup, base metal preparation, electrode selection, and fundamental joint creation in various positions. Students learn to assess weld quality through visual inspection and industry-standard measurements and aligns to AWS specifications.** 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 interviews or job shadowing relevant to the program of study.** 2.E

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tudents 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 where welding skills are required. 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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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. Use basic arithmetic, measurement, and geometry for welding layouts and joint preparation. They calculate dimensions, angles for bevels, and material quantities. Mathematical applications include determining proper amperage settings based on electrode size and material thickness, measuring weld sizes, calculating material usage rates and measuring in decimals and fractions. 3.D.2
3. Use scientific principles intermediate physics and metallurgy concepts specific to welding processes. They learn principles of electricity and magnetism in SMAW operations, thermal dynamics in metal heating and cooling cycles, and physical properties of base metals and electrodes. The curriculum covers gas laws for oxyfuel operations, chemical reactions in flux and slag formation, and molecular behavior of shielding gases. Students also study basic metallurgy including metal crystalline structures, phase transformations, and weld zone composition. 3.D.3

E The student demonstrates comprehensive knowledge of welding safety practices and procedures. The student is expected to: 3.E

1. Analyze potential hazards in welding operations and implement appropriate safety measures. 3.E.1
2. Evaluate and select proper Personal Protective Equipment (PPE) for specific welding tasks. 3.E.2
3. Demonstrate proper ventilation setup and maintenance procedures. 3.E.3
4. Execute emergency response procedures for welding-related incidents. 3.E.4

F The student demonstrates mastery of oxyfuel cutting processes. The student is expected to: 3.F

1. Set up and inspect oxyfuel cutting equipment according to manufacturer specifications. 3.F.1
2. Demonstrate safe oxyfuel working practices. 3.F.2
3. Perform straight, bevel, and piercing cuts meeting industry standards. 3.F.3
4. Troubleshoot common cutting problems and implement solutions. 3.F.4
5. Execute proper shutdown and maintenance procedures. 3.F.5

G The student applies knowledge of metal preparation techniques. The student is expected to: 3.G

1. Analyze metal properties to determine appropriate preparation methods. 3.G.1
2. Execute cleaning and beveling techniques to prepare metals for welding. 3.G.2
3. Measure and verify joint fit-up according to specifications. 3.G.3
4. Demonstrate proficiency in fit-up and layout of parts. 3.G.4
5. Select appropriate preparation tools based on metal type and thickness. 3.G.5

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H **The student demonstrates proficiency in SMAW equipment operation. The student is expected to:** 3.H

1. Configure SMAW equipment for various welding operations. 3.H.1
2. Determine appropriate amperage settings for different electrodes and positions. 3.H.2
3. Diagnose and resolve common SMAW equipment malfunctions. 3.H.3
4. Perform routine maintenance procedures on SMAW equipment. 3.H.4
5. Demonstrate proper shut-down procedures. 3.H.5

I **The student demonstrates understanding of electrode selection and bead formation. The student is expected to:** 3.I

1. Classify electrodes based on their specifications and applications. 3.I.1
2. Evaluate weld bead appearance to determine quality and needed adjustments. 3.I.2
3. Execute proper electrode manipulation techniques for various welding positions. 3.I.3
4. Maintain proper work and travel angles during bead formation. 3.I.4

J **The student demonstrates competency in creating SMAW joints in various positions. The student is expected to:** 3.J

1. Create fillet welds in all positions meeting AWS standards, safely. 3.J.1
2. Produce groove welds in all positions meeting AWS standards, safely. 3.J.2
3. Apply proper techniques for tack welding and joint alignment. 3.J.3
4. Analyze and correct weld joint defects. 3.J.4

K **The student demonstrates fundamental knowledge of wire-fed welding processes. The student is expected to:** 3.K

1. Set up GMAW and FCAW equipment according to manufacturer specifications. 3.K.1
2. Select appropriate wire types and sizes for specific applications. 3.K.2
3. Perform basic GMAW and FCAW operations in flat and horizontal positions. 3.K.3
4. Troubleshoot common wire-feed welding problems. 3.K.4
5. Demonstrate proper shut-down procedures. 3.K.5

L **The student evaluates weld quality using industry standards. The student is expected to:** 3.L

1. Identify common weld defects and their causes. 3.L.1
2. Perform visual inspection of completed welds using AWS criteria. 3.L.2
3. Measure weld size and profile using appropriate gauges. 3.L.3

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4 Document weld quality findings according to industry standards. The following standards are specifically for American Welding Society Sense Level I certification: 3.L.4

M The student demonstrates SENSE Level I occupational orientation and safety. The student is expected to: 3.M

1 Describe roles, pathways, and credentialing in the welding industry (SENSE Module 1: Occupational Orientation). 3.M.1

2 Apply welding-specific safety and health practices (arc radiation, electrical, fumes, cylinders, hot work permits) (SENSE Module 2; AWS Z49.1). 3.M.2

N The student interprets drawings and welding symbols. The student is expected to: 3.N

1 Read basic fabrication drawings (views, scales, dimensions) and identify joint types. 3.N.1

2 Interpret AWS welding symbols (groove/fillet, size, length, pitch, contour, finish) in accordance with SENSE Module 3. 3.N.2

O The student performs thermal cutting processes. The student is expected to: 3.O

1 Set up and perform manual oxyfuel gas cutting (OFC) to make straight, bevel, and pierce cuts to tolerance. 3.O.1

2 Describe mechanized OFC and perform basic operations where available. 3.O.2

3 Set up and perform manual plasma arc cutting (PAC) to tolerance; troubleshoot common cut defects. (SENSE Module 8, Units 1–3). 3.O.3

P The student demonstrates SMAW fundamentals and fillet welds. The student is expected to: 3.P

1 Set up SMAW equipment; select electrodes and parameters for carbon steel. 3.P.1

2 Deposit 1F/2F fillet welds on carbon steel T-joints meeting visual acceptance criteria of SENSE workmanship tests; identify/correct discontinuities. (SENSE Module 4; acceptance tested per EG2.0 technique sheets). 3.P.2

Q The student demonstrates GMAW (short-circuit) fundamentals. The student is expected to: 3.Q

1 Set up GMAW equipment; select wire, gas, and parameters for carbon steel. 3.Q.1

2 Deposit flat/horizontal fillet welds (1F/2F) meeting SENSE visual acceptance criteria; document parameters and results. (SENSE Module 5). 3.Q.2

R The student demonstrates FCAW fundamentals. The student is expected to: 3.R

1 Set up FCAW-S and FCAW-G; select wire, gas, and parameters for carbon steel. 3.R.1

2 Deposit flat/horizontal fillet welds (1F/2F) meeting SENSE visual acceptance criteria; troubleshoot porosity, lack of fusion, worm tracking. (SENSE Module 6). 3.R.2

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S **The student evaluates weld quality to SENSE Level I workmanship criteria. The student is expected to:** 3.S

1. Perform visual inspection of fillet welds (leg size, throat, profile, undercut, overlap) using gauges and SENSE acceptance standards. 3.S.1
2. Record inspection results on SENSE-style forms and recommend corrective actions. (QC10 requires passing knowledge + workmanship/performance tests for completion.) 3.S.2