

North Dakota Welding Education

Content Standards

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North Dakota Technical Education Team and Standards Process

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Career and Technical Education Standards Introduction

Mission

The mission of the State Board for Career and Technical Education (CTE) is to work with others to provide all North Dakota citizens with the technical skills, knowledge, and attitudes necessary for successful performance in a globally competitive workplace.

Vision

The State Board for Career and Technical Education (CTE) is committed to providing career awareness, work readiness skills, occupational preparation, and retraining of workers throughout the state. Career and technical education will span all educational levels, providing youth with exploration opportunities and the foundation skills needed to enter the world of work while providing adults with skills needed to enter, re-enter, or advance in the workforce.

Goal

North Dakota Career and Technical Education's goal is to create a competitive and knowledgeable work force. This is accomplished through a variety of educational program areas that are organized to prepare students for careers in their chosen fields, to take leadership roles, and balance their multiple roles in life. CTE programs prepare students with the knowledge and skills to make informed career choices, to integrate and apply academic concepts, to prepare for successful participation in a global society, and to engage in lifelong learning.

Standards Development Process

Standards development is a multi-phase process. Existing and/or industry standards are the basis for the North Dakota Program Standards. A team of expert secondary and postsecondary teachers, business and industry representatives, and the state program supervisor draft the standards document. Once the document is finalized, the State Board for Career and Technical Education approves and adopts the standards.

Course Frameworks are also developed by the writing team. A framework includes a brief overview of the course content, topical units of study, and identifies the standards recommended for inclusion within the course. The frameworks are tailored to prepare young people for the opportunities in North Dakota. School Districts will use the frameworks as a guide for developing curriculum that reflects local needs.

Key Principles of Career and Technical Education

We believe that Career Technical Education:

1. Draws its curricula, standards, and organizing principles from the workplace.

The workplace provides the context, objectives, and organizing constructs for instruction and assessment. The workplace also defines the standards of performance necessary, including those required for academic, technical, and employability skills.

2. Is a critical and integral component of the total educational system, offering career-oriented benefits for all students.

CTE classes offer educational benefits to students pursuing careers requiring specific technical skills as well as providing a strong foundation for those pursuing a traditional four-year (or more) degree.

3. Is a critical and integral component of the workforce development system, providing the essential foundation for a thriving economy.

Preparation of a well-prepared, qualified workforce requires solid academics, good work ethics, and specific technical skills as well as the ability to communicate, work with others, solve problems, and use information. CTE contributes directly to this preparation by providing a curriculum tied to specific workplace requirements.

4. Maintains high levels of excellence supported through identification of academic and workplace standards, measurement of performance (accountability), and high expectations for participant success.

Career Technical Education is committed to continuous improvement, attention to industry certification, and the development of highly qualified teachers.

5. Is robust and flexible enough to respond to the needs of the multiple educational environments, customers, and levels of specialization.

CTE involves a large and complex delivery system that (1) integrates career exploration, (2) provides effective tools for organizing all curricula, (3) facilitates the teaching and use of technology, (4) is integrated into the total learning experience, (5) enhances the learning of academic subjects, (6) teaches broad occupational skills, (7) includes all aspects of the industry, (8) teaches how to balance family and work responsibilities, (9) provides job-specific training, (10) is offered at multiple levels of the educational continuum, and (11) is delivered through a variety of educational environments.

Table of Contents

Publication Availability	1
State Board Members	2
Introduction to CTE Standards.....	3
Principles of Career and Technical Education	4
Table of Contents	5
Welding Basic Orientation	6
Welding Types and Operations	7
Thermal Cutting Processes	9
Career Ready Practices	11

Standard 1	<i>WELDING BASIC ORIENTATION</i>	
Topic 1.1	Occupational Orientation	
	Student Competencies	
	1.1.1	Fills out, maintain, and submit a time card, or work assignment card, and other records as required by an institution.
	1.1.2	Performs general housekeeping duties to maintain workspace, equipment, and tool cleanliness.
	1.1.3	Follows detailed verbal instructions given by an immediate supervisor to set up and carry out specific assignments.
	1.1.4	Follows detailed written instructions given by an immediate supervisor to set up and carry out specific assignments.
Topic 1.2	Safety and Health	
	Student Competencies	
	1.2.1	Shows proper use and inspection of Personal Protective Equipment (PPE) while conducting, or in the vicinity of welding and cutting activities.
	1.2.2	Follows procedures established using the concepts and requirements from NFPA and OSHA to ensure the safety of the work area and the general public.
	1.2.3	Is aware of the dangers associated with welding and brazing fumes, and uses the best possible means of ventilation available for the capture of welding and brazing fumes as close to the source as possible.
	1.2.4	Follows established procedures and policies for implementing of emergency action plans and for the use of safety equipment and demonstrates proper Hot Zone operation.
	1.2.5	Follows established procedures and policies for working in confined areas.
	1.2.6	Demonstrates proper use of precautionary labeling as well as SDS and MSDS (Material Safety Data Sheets) information.
	1.2.7	Demonstrates proper inspection and operation of equipment used for each welding and thermal cutting process.
Topic 1.3	Drawing and Welding Symbol Interpretation	
	Student Competencies	
	1.3.1	Interprets basic elements of a drawing or sketch.
	1.3.2	Interprets welding symbol information.
	1.3.3	Fabricates parts from a drawing or sketch.
Topic 1.4	Welding Inspection and Testing	
	Student Competencies	
	1.4.1	Examines cut surfaces and edges of prepared base metal parts.
	1.4.2	Examines tacks, root passes, intermediate layers, and completed welds.

Standard 2	<i>WELDING TYPES AND OPERATIONS</i>	
Topic 2.1	Shielded Metal Arc Welding (SMAW)	
	Student Competencies	
	2.1.1	Performs safety inspections of SMAW equipment and accessories.
	2.1.2	Makes minor external repairs to SMAW equipment and accessories.
	2.1.3	Sets up for SMAW operations on carbon steel.
	2.1.4	Operates SMAW equipment on carbon steel.
	2.1.5	Makes fillet welds, in all positions, on carbon steel.
	2.1.6	Makes groove welds, in all positions, on carbon steel.
	2.1.7	Passes SMAW welder performance qualification test (2G and 3G, uphill, limited thickness test plates) on carbon steel.
Topic 2.2	Gas Metal Arc Welding (GMAW-S, GMAW spray transfer)	
	Student Competencies	
	2.2.1	Performs safety inspections of GMAW equipment and accessories.
	2.2.2	Makes minor external repairs to GMAW equipment and accessories.
	<i>Short Circuiting Transfer</i>	
	2.2.3	Sets up for GMAW-S operations on carbon steel.
	2.2.4	Operates GMAW-S equipment on carbon steel.
	2.2.5	Makes fillet welds, in all positions, on carbon steel.
	2.2.6	Makes groove welds, in all positions, on carbon steel.
	2.2.7	Passes GMAW-S workmanship qualification test on carbon steel.
	<i>Spray Transfer</i>	
	2.2.8	Sets up for GMAW (spray) operations on carbon steel.
	2.2.9	Operates GMAW (spray) equipment on carbon steel.
	2.2.10	Makes fillet welds in the 1F and 2F positions on carbon steel.
	2.2.11	Makes groove welds in the 1G position on carbon steel.
	2.2.12	Passes GMAW (spray) workmanship qualification test on carbon steel.
Topic 2.3	Flux Cored Arc Welding (FCAW-G/GM, FCAW-S)	
	Student Competencies	
	2.3.1	Performs safety inspections of FCAW equipment and accessories.
	2.3.2	Makes minor external repairs to FCAW equipment and accessories.
	<i>Gas Shielded</i>	
	2.3.3	Sets up for FCAW-G/GM operations on carbon steel.
	2.3.4	Operates FCAW-G/GM equipment on carbon steel.

	2.3.5	Makes fillet welds, in all positions, on carbon steel.
	2.3.6	Makes groove welds, in all positions, on carbon steel.
	2.3.7	Passes FCAW-G/GM welder performance qualification test on carbon steel.
		<i>Self-Shielded</i>
	2.3.8	Sets up for FCAW- S operations on carbon steel.
	2.3.9	Operates FCAW- S equipment on carbon steel.
	2.3.10	Makes fillet welds in all positions on carbon steel.
	2.3.11	Makes groove welds in all positions on carbon steel.
2.3.12	Passes FCAW-S welder performance qualification test on carbon steel.	
Topic 2.4	Gas Tungsten Arc Welding (GTAW)	
	Student Competencies	
	2.4.1	Performs safety inspections of GTAW equipment and accessories.
	2.4.2	Makes minor external repairs to GTAW equipment and accessories.
		<i>Carbon Steel</i>
	2.4.3	Sets up for GTAW operations on carbon steel.
	2.4.4	Operates GTAW equipment on carbon steel.
	2.4.5	Makes fillet welds, in all positions, on carbon steel.
	2.4.6	Makes groove welds, in all positions, on carbon steel.
	2.4.7	Passes GTAW welder performance qualification test on carbon steel.
		<i>Austenitic Stainless Steel</i>
	2.4.8	Sets up for GTAW operations on austenitic stainless steel.
	2.4.9	Operates GTAW equipment on austenitic stainless steel.
	2.4.10	Makes fillet welds in the 1F, 2F, and 3F positions, on austenitic stainless steel.
	2.4.11	Makes groove welds in the 1G and 2G positions, on austenitic stainless steel.
	2.4.12	Passes GTAW workmanship qualification test on austenitic stainless steel.
		<i>Aluminum</i>
	2.4.13	Sets up for GTAW operations on aluminum.
	2.4.14	Operates GTAW equipment on aluminum.
2.4.15	Makes fillet welds in the 1F and 2F positions, on aluminum.	
2.4.16	Makes groove welds in the 1G position, on aluminum.	
2.4.17	Passes GTAW workmanship qualification test on aluminum.	

Standard 3	<i>THERMAL CUTTING PROCESSES</i>	
Topic 3.1	Manual Oxyfuel Gas Cutting (OFC)	
	Student Competencies	
	3.1.1	Performs safety inspections of manual OFC equipment and accessories.
	3.1.2	Makes minor external repairs to manual OFC equipment and accessories.
	3.1.3	Sets up for manual OFC operations on carbon steel.
	3.1.4	Operates manual OFC equipment on carbon steel.
	3.1.5	Performs straight, square edge cutting operations, in the flat position, on carbon steel.
	3.1.6	Performs shape, square edge cutting operations, in the flat position, on carbon steel.
	3.1.7	Performs straight, bevel edge cutting operations, in the flat position, on carbon steel.
	3.1.8	Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions, on carbon steel.
Topic 3.2	Mechanized Oxyfuel Gas Cutting (OFC) [e.g., Track Burner]	
	Student Competencies	
	3.2.1	Performs safety inspections of mechanized OFC equipment and accessories.
	3.2.2	Makes minor external repairs to mechanized OFC equipment and accessories.
	3.2.3	Sets up for mechanized OFC operations on carbon steel.
	3.2.4	Operates mechanized OFC equipment on carbon steel.
	3.2.5	Performs straight, square edge cutting operations in the flat position, on carbon steel.
	3.2.6	Performs straight, bevel edge cutting operations in the flat position, on carbon steel.
Topic 3.3	Manual Plasma Arc Cutting (PAC)	
	Student Competencies	
	3.3.1	Performs safety inspections of manual PAC equipment and accessories.
	3.3.2	Makes minor external repairs to manual PAC equipment and accessories.
	3.3.3	Sets up for manual PAC operations on carbon steel, austenitic stainless steel, and aluminum.
	3.3.4	Operates manual PAC equipment on carbon steel, austenitic stainless steel, and aluminum.
	3.3.5	Performs straight, square edge cutting operations, in the flat position, on carbon steel, austenitic stainless steel, and aluminum.
	3.3.6	Performs shape, square edge cutting operations, in the flat position, on carbon steel, austenitic stainless steel, and aluminum.
Topic 3.4	Manual Air Carbon Arc Cutting (CAC-A)	
	Student Competencies	
	3.4.1	Performs safety inspections of manual CAC-A equipment and accessories.
	3.4.2	Makes minor external repairs to manual CAC-A equipment and accessories.

	3.4.3	Sets up for manual CAC-A scarfing and gouging operations on carbon steel.
	3.4.4	Operates manual CAC-A equipment on carbon steel.
	3.4.5	Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions, on carbon steel.

Career Ready Practices

1. Act as a Responsible and Contributing Citizen and Employee

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them, think about the near-term and long-term consequences of their actions, and seek to act in ways that contribute to the betterment of their teams, families, community, and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

2. Apply Appropriate Academic and Technical Skills

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications and make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

3. Attend to Personal Health and Financial Well-Being

Career-ready individuals understand the relationship between personal health, workplace performance, and personal well-being; they act on that understanding to regularly practice health diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

4. Communicate Clearly, Effectively, and with Reason

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice and organization and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

5. Consider the environmental, social, and economic impacts of decisions

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment. They are aware of and utilize new technologies, understandings, procedures, materials and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and profitability of the organization.

6. Demonstrate creativity and innovation

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

7. Employ valid and reliable research strategies

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices, or inform strategies. They use a reliable research process to search for new information and evaluate the validity of sources when considering the use and adoption of external information or practices. They use an informed process to test new ideas, information, and practices in their workplace situation.

8. Utilize critical thinking to make sense of problems and persevere in solving them

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur, quickly take action to address the problem, thoughtfully investigate the root cause of the problem prior to introducing solutions, and carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

9. Model integrity, ethical leadership, and effective management

Career-ready individuals consistently act in ways that align to personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes, and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

10. Plan education and career path aligned to personal goals

Career-ready individuals take personal ownership of their own educational and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience, and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the educational and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

11. Use technology to enhance productivity

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology, being proficient with ubiquitous technology applications. They understand the inherent risks, personal and organizational, of technology applications, and they take actions to prevent or mitigate these risks.

12. Work productively in teams while using cultural/global competence

Career-ready individuals positively contribute to every team whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.