Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter O. Manufacturing

Statutory Authority: The provisions of this Subchapter O issued under Texas Education Code, §§7.102(c)(4), 28.002(a) and (c), and 28.025, unless otherwise noted.

§127.810. Principles of Manufacturing (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 9-12. Recommended prerequisite: Algebra I or Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Principles of Manufacturing, students are introduced to knowledge and skills used in the proper application of principles of manufacturing. The study of manufacturing technology allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities. Students will gain an understanding of what employers require to gain and maintain employment in manufacturing careers.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies manufacturing concepts to specific problems. The student is expected to:

(A) distinguish between disciplines such as engineering, science, manufacturing, and technology;

(B) use tools such as calculators and computers to solve problems; and

(C) use a variety of measuring instruments.

(2) The student applies communication, mathematics, and science knowledge and skills to manufacturing activities. The student is expected to:

(A) demonstrate communication techniques consistent with industry standards;

(B) locate relevant information needed to solve problems;

(C) apply mathematics concepts to solve manufacturing problems;

(D) analyze science principles used to solve problems; and

(E) use the appropriate units of measure.

(3) The student manufactures products using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:

(A) analyze the processes needed to complete a project such as initiate, plan, execute, monitor and control, and close; and

(B) use a variety of tools and equipment to produce an item.

(4) The student practices safe work habits. The student is expected to:

(A) master relevant safety tests based on OSHA guidelines and principles; and

(B) use Material Safety Data Sheets (MSDS) to analyze, store, and safely dispose of hazardous materials.

(5) The student describes the importance of maintenance. The student is expected to:

(A) perform maintenance on selected equipment; and

(B) analyze the results of improper maintenance.

(6) The student describes the factors that affect the evolution of technology. The student is expected to:

(A) analyze how changes in technology affect manufacturing practices;

(B) evaluate how the development of technology in manufacturing is influenced by past events;

(C) analyze the international effects of technology;

(D) demonstrate how advancements in technology have affected the field of engineering; and

(E) evaluate the factors that affect the implementation of new ideas.

(7) The student selects and reports on career opportunities, requirements, and expectations in manufacturing and technology. The student is expected to:

(A) investigate an area of interest in manufacturing;

(B) analyze the various specializations in manufacturing; and

(C) describe the functions of engineers, technologists, and technicians.

Source: The provisions of this §127.810 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.811. Diversified Manufacturing I (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Algebra I. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Diversified Manufacturing I, students gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. The study of manufacturing systems allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting. Diversified Manufacturing I allows students the opportunity to understand the process of mass production by using a wide variety of materials and manufacturing techniques. Knowledge about career opportunities, requirements, and expectations and the development of skills prepare students for workplace success.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies academic skills to the requirements of manufacturing. The student is expected to:

(A) demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers;

(B) interpret engineering drawings, charts, diagrams, and welding symbols; and

(C) select algebraic and geometric principles and formulas required for precision measuring operations.

(2) The student differentiates between the technical concepts that form the knowledge and skills of manufacturing. The student is expected to:

(A) use tools and equipment commonly employed in manufacturing in a safe manner;

(B) demonstrate an understanding of the safety regulations for the different types of manufacturing equipment such as cutting, abrasive, boring, turning, shaping, and forming tools;

(C) execute procedures using the different types of manufacturing equipment such as cutting, abrasive, boring, turning, shaping, and forming tools;

(D) research the modern materials used in manufacturing; and

(E) perform varied measurements, including precision measurements.

(3) The student investigates emerging and innovative applications of technology in engineering. The student is expected to:

(A) report on innovative applications of technology in engineering;

(B) experiment with new technologies; and

(C) experiment with different manufacturing materials such as plastic, composites, fiberglass, stone, and wood.

(4) The student manufactures products or systems using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:

(A) analyze the processes needed to complete a project such as initiate, plan, execute, monitor and control, and close; and

(B) use a variety of equipment and machines to produce an item to specification.

(5) The student practices safe work habits. The student is expected to:

(A) master safety tests developed from Occupational Safety and Health Administration regulations;

(B) analyze hazardous materials;

(C) dispose of hazardous materials safely; and

(D) store all materials correctly.

(6) The student participates in a mass manufacturing project. The student is expected to:

(A) participate in the manufacturing of a mass produced project; and

(B) develop a method to check and maintain quality control throughout the manufacturing process.

(7) The student identifies the factors that influence the cost of an item or service. The student is expected to:

(A) develop a budget for a project; and

(B) determine the most effective strategies to minimize costs.

(8) The student describes the relationship between manufacturing and marketing. The student is expected to:

(A) prepare a marketing plan for a product;

(B) analyze the effect of customer satisfaction on the image of a product; and

(C) analyze how customer demands influence the design of an object.

(9) The student applies communication, mathematics, and science knowledge and skills to manufacturing activities. The student is expected to:

(A) demonstrate communication techniques consistent with industry standards;

(B) locate relevant information needed to solve problems;

(C) apply mathematics concepts to solve manufacturing problems;

(D) analyze science principles used to solve problems; and

(E) use appropriate units of measure.

Source: The provisions of this §127.811 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.812. Diversified Manufacturing II (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Diversified Manufacturing I. Recommended prerequisite: Algebra I. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Diversified Manufacturing II, students will gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. The study of manufacturing systems allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting. Diversified Manufacturing II allows students the opportunity to understand the process of mass production by using a wide variety of materials and manufacturing techniques. Knowledge about career opportunities, requirements, and expectations and the development of skills prepare students for workplace success.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies academic skills to the requirements of manufacturing. The student is expected to:

(A) demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers;

(B) interpret engineering drawings, charts, diagrams, and welding symbols;

(C) select algebraic and geometric principles and formulas required for precision measuring operations;

(D) develop the information needed to mass produce a simple project such as flow charts, schedules, equipment lists, and material lists; and

(E) explore the use of jigs and fixtures in mass production.

(2) The student differentiates among the technical concepts that form the knowledge and skills of manufacturing. The student is expected to:

(A) use tools and equipment commonly employed in manufacturing in a safe manner;

(B) adhere to safety regulations for the different types of manufacturing equipment such as cutting, abrasive, boring, turning, shaping, and forming tools;

(C) execute procedures using the different types of manufacturing equipment such as cutting, abrasive, boring, turning, shaping, and forming tools;

(D) perform varied measurements, including precision measurements;

(E) design and develop the jigs and fixtures for a simple four (or fewer) part product; and

(F) participate in the production run off of the product.

(3) The student learns skills in production and programming of computer numerical control (CNC) operations. The student is expected to:

(A) develop a CNC program using a computer-aided manufacturing (CAM) program; and

(B) execute the CNC program to machine a product or run a simulation of the program.

(4) The student investigates emerging and innovative applications of technology in manufacturing. The student is expected to:

(A) research innovative technologies in manufacturing; and

(B) experiment with different manufacturing materials such as plastic, composites, fiberglass, stone, and wood.

(5) The student manufactures products or systems using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:

(A) analyze engineering properties such as the processes needed to complete a project;

(B) analyze the processes needed to complete a project such as initiate, plan, execute, monitor and control, and close; and

(C) use a variety of tools and equipment to produce a product to specification.

(6) The student practices safe work habits. The student is expected to:

(A) master safety tests based on Occupational Safety and Health Administration regulations;

(B) analyze hazardous materials;

(C) dispose of hazardous materials; and

(D) store all materials safely.

(7) The student participates in the manufacturing of a mass-produced product. The student is expected to:

(A) participate in the manufacturing of products; and

(B) develop a method to check and maintain quality control throughout the manufacturing process.

(8) The student identifies the factors that influence the cost of an item. The student is expected to:

(A) calculate costs associated with production of a mass-produced product; and

(B) re-examine the manufacturing process to maximize efficiency and minimize costs without compromising the integrity and marketability of the product.

(9) The student describes the relationship between manufacturing and marketing. The student is expected to:

(A) prepare a marketing plan for a product;

(B) analyze the effect of customer satisfaction on the image of a product; and

(C) analyze how customer demands influence the design of an object.

(10) The student applies communication, mathematics, and science knowledge and skills to manufacturing activities. The student is expected to:

(A) demonstrate communication techniques consistent with industry standards;

(B) locate relevant information needed to solve problems;

(C) apply mathematics concepts to solve manufacturing problems;

(D) analyze science principles used to solve problems; and

(E) use appropriate units of measure.

Source: The provisions of this §127.812 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.813. Manufacturing Engineering Technology I (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Algebra I. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Manufacturing Engineering Technology I, students will gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. Students will prepare for success in the global economy. The study of manufacturing engineering will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings in a manufacturing setting.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies software skills to manufacturing. The student is expected to:

(A) use computer-aided design (CAD) software to complete a design;

(B) analyze the results of product testing in a simulated modeling environment; and

(C) fabricate a prototype design of a mechanical part.

(2) The student gains skills in writing programmable logic controls so that a robot can work in coordination with a machine. The student is expected to:

(A) use computer-integrated manufacturing techniques to simulate a manufacturing process; and

(B) troubleshoot programmable logic circuit devices.

(3) The student performs functions and solves problems in the electricity and electronics field. The student is expected to:

(A) research the use of control devices; and

(B) demonstrate the use of control devices.

(4) The student learns skills in production and programming of computer numerical control (CNC) operations. The student is expected to:

(A) design a product using computer-aided manufacturing (CAM) software for production on a CNC lathe;

(B) produce a product on the CNC lathe or a simulation;

(C) design a product using CAM software for production on a CNC mill;

(D) produce a product on the CNC mill or a simulation; and

(E) complete data sheets for plan, do, check, and act forms and projects.

(5) The student knows mechanical and fluid systems. The student is expected to:

(A) identify, describe, and demonstrate the use of mechanical devices; and

(B) identify, describe, and demonstrate the use of fluid devices.

(6) The student knows electrical and thermal systems. The student is expected to:

(A) identify and describe electrical devices;

(B) demonstrate the use of electrical devices; and

(C) research the effects of heat energy and temperature on products.

(7) The student understands quality-control systems. The student is expected to:

(A) research and recognize industrial standards such as International Standards Organization and Military Specifications;

(B) explain attribute and Pareto charts; and

(C) apply statistical process control.

Source: The provisions of this §127.813 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.814. Manufacturing Engineering Technology II (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Manufacturing Engineering Technology I. Recommended prerequisite: Algebra II, Computer Science I, or Physics. This course satisfies a high school mathematics graduation requirement. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support

activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Manufacturing Engineering Technology II, students will gain knowledge and skills in the application, design, production, and assessment of products, services, and systems and how those knowledge and skills are applied to manufacturing. The study of Manufacturing Engineering Technology II will allow students to reinforce, apply, and transfer academic knowledge and skills to a variety of interesting and relevant activities, problems, and settings.

(4) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(5) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(6) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(2) The student applies design skills to manufacturing. The student is expected to:

(A) use computer-aided design (CAD) software to complete a design;

(B) analyze the results of product testing in a simulated modeling environment;

(C) fabricate a prototype design of a mechanical part; and

(D) use computer-integrated manufacturing techniques to simulate a manufacturing process.

(3) The student performs functions and solves problems in the electricity and electronics field. The student is expected to:

(A) develop solutions to use control devices; and

(B) troubleshoot control devices such as programmable logic circuit devices.

(4) The student learns skills in production and programming of computer numerical control (CNC) operations. The student is expected to:

(A) design a project using computer-aided manufacturing (CAM) software for a CNC lathe;

(B) produce a product on a CNC lathe or simulator;

(C) design a project using CAM software for a CNC mill;

(D) produce a product on a CNC mill or simulator; and

(E) complete data sheets for plan, do, check, and act forms and projects.

(5) The student demonstrates an understanding of mechanical and fluid systems. The student is expected to:

(A) use mechanical devices;

(B) use pneumatics devices; and

(C) use hydraulics devices.

(6) The student demonstrates an understanding of electrical and thermal systems. The student is expected to:

(A) use electrical controls;

(B) analyze the effects of heat energy and temperature on products; and

(C) develop an understanding of ventilation such as heating, air conditioning, and refrigeration.

(7) The student analyzes quality-control systems. The student is expected to:

(A) apply statistical process control;

(B) determine hardness values of different materials; and

(C) analyze attribute and Pareto charts.

(8) The student develops a system using electrical controls and pneumatics or hydraulics devices. The student is expected to:

(A) design a system that incorporates electrical controls and either a pneumatic or hydraulic device;

(B) build a system that incorporates electrical controls and either a pneumatic or hydraulic device; and

(C) test and troubleshoot the system that incorporates electrical controls and either a pneumatic or hydraulic device.

Source: The provisions of this §127.814 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.815. Metal Fabrication and Machining I (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Algebra I or Geometry. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Metal Fabrication and Machining I provides the knowledge, skills, and certifications required for equal employment opportunities in the metal production industry. Students must have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies academic skills to the requirements of metal manufacturing. The student is expected to:

(A) demonstrate effective oral and written communication skills with individuals from varied cultures, including fellow workers, management, and customers;

(B) interpret engineering drawings, charts, diagrams, and welding symbols; and

(C) select algebraic and geometric principles and formulas required for precision measuring operations.

(2) The student differentiates the technical concepts that form the knowledge and skills of metal manufacturing. The student is expected to:

(A) analyze the resources found in The Machinery's Handbook as well as the specifications and codes written by the American Welding Society (AWS), Canadian Welding Bureau (CWB), American National Standards Institute (ANSI), and American Petroleum Institute (API);

(B) examine the theory of shielded metal arc welding and gas metal arc welding;

(C) examine the sheet metal industry; and

(D) examine the nomenclature of abrasive wheels.

(3) The student differentiates the function and application of the tools, equipment, technologies, and materials used in metal manufacturing. The student is expected to:

(A) use hand and power tools and equipment commonly employed in metal manufacturing; and

(B) dispose of environmentally hazardous materials used in metal manufacturing.

(4) The student applies the technical concepts and skills of the machining industry to simulated and actual work situations. The student is expected to:

(A) use various work mounting procedures on all appropriate machines;

(B) operate machine tools such as drill press, lathe, saw, grinders, and milling machines;

(C) execute lathe procedures such as cutting threads, turning tapers, drilling, reaming, polishing, knurling, and boring; and

(D) execute milling procedures such as milling flat surfaces, bevels, chamfers, grooves, and key-way seats needed to machine precision pieces.

(5) The student applies the technical concepts and skills of the welding industry to simulated and actual work situations. The student is expected to:

(A) perform cutting processes such as straight cuts, bevel cuts, and hole piercing with oxy-fuel and plasma;

(B) use the common types of electrodes with the shield metal arc welding process;

(C) practice using gas metal arc welding to weld in multiple positions to produce groove and fillet welds; and

(D) inspect groove and fillet welds to AWS, CWB, ANSI, and API codes.

(6) The student applies the technical concepts and skills of the sheet metal industry to simulate actual work situations. The student is expected to:

(A) use mathematics in precision measuring operations; and

(B) interpret, engineering drawings, charts, and diagrams as related to the sheet metal industry.

(7) The student differentiates the concepts that form the technical knowledge and skills of sheet metal manufacturing. The student is expected to:

(A) analyze the types, sizes, and properties of sheet metal materials;

(B) analyze the fundamentals of oxy-fuel processes as related to sheet metal; and

(C) analyze the fundamentals of shielded metal arc welding and gas metal arc welding as related to sheet metal under various AWS codes.

(8) The student understands the function and application of the tools, equipment, technologies, and materials used in sheet metal manufacturing. The student is expected to:

(A) practice safe use of equipment; and

(B) dispose of hazardous materials used in sheet metal manufacturing.

(9) The student applies the knowledge and skills of sheet metal manufacturing in simulated and actual work situations. The student is expected to:

(A) draw simple metal layouts; and

(B) construct common sheet metal seams.

Source: The provisions of this §127.815 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.816. Metal Fabrication and Machining II (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Metal Fabrication and Machining I. Recommended prerequisites: Geometry and Algebra II. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Metal Fabrication and Machining II builds on the knowledge, skills, and certifications students acquire in Metal Fabrication and Machining I. Students will develop advanced concepts and skills as related to personal and career development. This course integrates academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:

(A) use teamwork to solve problems;

(B) distinguish among team roles such as team leaders and team members;

(C) discuss Equal Employment Opportunity law in the workplace; and

(D) use time-management techniques to develop work schedules.

(2) The student applies advanced academic skills to the requirements of metal fabrication and machining. The student is expected to:

(A) demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;

(B) successfully complete work orders;

(C) estimate labor costs using various algebraic formulas;

(D) interpret advanced engineering drawings, charts, diagrams, and welding symbols; and

(E) demonstrate calculation of precision measuring operations using algebra, geometry, and trigonometry.

(3) The student knows the advanced concepts that form the technical knowledge and skills of metal fabrication and machining. The student is expected to:

(A) analyze the resources found in various manufacturing reference materials;

(B) demonstrate knowledge of the various welding processes;

(C) examine the sheet metal industry; and

(D) examine the advanced use of abrasives.

(4) The student knows the function and application of the tools, equipment, technologies, and materials used in metal fabrication and machining. The student is expected to:

(A) operate various welding machines, cutting equipment, and grinding equipment commonly employed in metal fabrication;

(B) demonstrate knowledge of computer numerical control (CNC) machines;

(C) demonstrate knowledge of the concepts of automated welding machines;

(D) demonstrate knowledge of emerging technologies that may affect metal manufacturing; and

(E) dispose of environmentally hazardous materials associated with and used in metal fabrication manufacturing.

(5) The student applies the advanced concepts and technical knowledge and skills of the machining industry to simulated and actual work situations. The student is expected to:

(A) use various work mounting procedures on appropriate machines;

(B) examine the cutting operations such as drill press, lathe, saw, grinders, and milling machines;

(C) execute lathe procedures such as cut threads, turn tapers, drills, reams, polishes, knurls, and bores;

(D) mill flat surfaces, bevels, chamfers, grooves, and key-seats; and

(E) machine precision pieces.

(6) The student applies the advanced concepts and technical knowledge and skills of the welding industry to simulated and actual work situations. The student is expected to:

(A) demonstrate cutting processes such as oxy-fuel and plasma;

(B) demonstrate the use of the common types of electrodes using the shielded metal arc welding process;

(C) use shielded metal arc welding, gas metal arc welding, and gas tungsten arc welding to weld fillet and groove welds using various positions; and

(D) inspect welds to the American Welding Society (AWS), Canadian Welding Bureau (CWB), American National Standards Institute (ANSI), and American Petroleum Institute (API) codes.

(7) The student applies the advanced concepts and technical knowledge and skills of the sheet metal industry to simulated and actual work situations. The student is expected to:

(A) estimate labor costs;

(B) use advanced mathematics in precision measuring operations; and

(C) interpret industrial standard blueprints, drawings, charts, and diagrams.

(8) The student knows the advanced concepts and technical knowledge and skills of sheet metal manufacturing. The student is expected to:

(A) analyze properties of sheet metal materials and fasteners;

(B) analyze oxy-fuel processes as related to sheet metal; and

(C) demonstrate knowledge of shielded metal arc welding, gas metal arc welding, and gas tungsten arc welding as related to sheet metal under AWS code.

(9) The student knows the function and application of the tools, equipment, technologies, and materials used in sheet metal. The student is expected to:

(A) use equipment commonly employed in sheet metal safely;

(B) dispose of environmentally hazardous materials used in sheet metal manufacturing properly; and

(C) demonstrate knowledge of emerging technologies that may affect sheet metal.

(10) The student applies the advanced concepts and technical skills in simulated and actual work situations. The student is expected to:

(A) draw advanced sheet metal layouts;

(B) construct sheet metal seams;

(C) construct transitions and offsets;

(D) use the gas tungsten arc welding process in sheet metal construction;

(E) apply the principles of sheet metal construction to the fabrication of various sheet metal products; and

(F) apply skills in sheet metal to career preparation learning experiences.

Source: The provisions of this §127.816 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.817. Precision Metal Manufacturing I (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Manufacturing and completion of or concurrent enrollment in Algebra I or Geometry. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Precision Metal Manufacturing I will provide the knowledge, skills, and technologies required for employment in precision machining. While the course is designed to provide necessary skills in machining, it also provides a real-world foundation for any engineering discipline. This course may address a variety of materials such as plastics, ceramics, and wood in addition to metal. Students will develop knowledge of the concepts and skills related to precision metal manufacturing to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about

career opportunities, requirements, and expectations and the development of workplace skills prepare students for success. This course is designed to provide entry-level employment for the student or articulated credit integration into a community college and dual credit with a community college with completion of the advanced course.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:

(A) determine academic knowledge and skills required for postsecondary education;

(B) identify employers' expectations to foster positive customer satisfaction;

(C) demonstrate the professional standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;

(D) evaluate personal career goals;

(E) communicate effectively with others in the workplace to clarify objectives; and

(F) demonstrate skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(2) The student applies advanced academic skills to the requirements of precision metal manufacturing. The student is expected to:

(A) demonstrate technical writing skills related to writing requirements found in manufacturing;

(B) demonstrate mathematical skills such as algebra, geometry, trigonometry, statics, and conversion as applied to machining;

(C) interpret engineering drawings, including drawings using geometric dimensioning and tolerancing;

(D) describe orthographic and isometric views of three-dimensional figures;

(E) evaluate mathematics as it applies to precision machining operations; and

(F) discuss basic concepts of physics as applied to machining.

(3) The student recognizes the concepts and skills that form the technical knowledge required in precision machining. The student is expected to:

(A) examine the resources found in recognized manufacturing reference materials such as The Machinery's Handbook; and

(B) demonstrate knowledge of the uses of reference charts such as tap drill charts, drill size charts, and feed-speed charts.

(4) The student evaluates the function and application of the tools, equipment, technologies, and materials used in precision machining. The student is expected to:

(A) practice safety while running equipment commonly employed in machine shops;

(B) identify and properly dispose of environmentally hazardous materials used in machine shops;

(C) demonstrate knowledge of computer numerical control (CNC) operations;

(D) demonstrate knowledge of emerging technologies that may affect the machine shop;

(E) demonstrate knowledge of heating metals such as hardening, tempering, annealing, normalizing, and case hardening steel;

(F) apply technical knowledge and skills in a machine shop to career preparation experiences;

(G) identify basic metallic and non-metallic materials; and

(H) compare various abrasives for type, structure, bond, and use.

(5) The student employs skills necessary to perform bench work and layout. The student is expected to:

(A) use equipment commonly employed in bench work and layout in a safe manner;

(B) develop the ability to use a file to cut flats, angles, and radiuses;

(C) employ standard layout tools to transfer a part design to the actual part;

(D) perform center punching and hand drilling of holes using an electric or air hand drill;

(E) perform hand tapping of holes;

(F) perform hand reaming of holes using an electric or air hand drill;

(G) develop a detailed layout part such as the National Institute for Metalworking Skills (NIMS) Level 1 layout part;

(H) develop a detailed bench work part such as the NIMS Level 1 bench work part; and

(I) employ basic housekeeping skills as applied to a machine shop.

(6) The student employs skills necessary to perform precision measurement. The student is expected to:

(A) use equipment commonly used during precision measurement in a safe manner;

(B) write an inspection plan;

(C) identify and select the required measuring instrument(s) to conduct the required inspection procedure(s); and

(D) describe statistical process control.

(7) The student employs skills necessary to perform manual lathe work. The student is expected to:

(A) use equipment such as accessories commonly implemented on and around a lathe in a safe manner;

(B) analyze the advantages and disadvantages between a four-jaw independent chuck, a three-jaw universal chuck, and a collet workholding system;

(C) indicate a part in a four-jaw independent chuck within.003" total indicated runout (TIR) using a standard indicator;

(D) identify and describe the function of the components of a lathe;

(E) identify and use most accessories and tooling for turning operations;

(F) demonstrate the standard turning operations of boring, chamfering, cutting tapers, drilling, facing, grooving, knurling, polishing, threading, and turning on a manual lathe;

(G) write a detailed process plan for turning, including appropriate processes such as feeds, speeds, tool selection, and sequencing;

(H) develop a detailed turning part such as the NIMS Level 1 turning, chucking or turning between centers part; and

(I) employ basic preventative maintenance on the lathe.

(8) The student employs skills necessary to perform manual milling work. The student is expected to:

(A) use equipment commonly used with a milling machine in a safe manner;

(B) analyze the advantages and disadvantages of various work holding methods such as using a vise, clamping to a table, and clamping to an angle plate;

(C) contrast the various ancillary tools used on milling machines such as a rotary table, indexing head, and super spacer;

(D) identify or describe the function of the components of a milling machine;

(E) tram in the head of a vertical milling machine;

(F) locate and set a work piece in a milling vise employing a dial indicator;

(G) develop a square block in the milling machine to close tolerances;

(H) demonstrate various hole-making activities such as spot drilling, drilling, reaming, tapping, countersinking, and boring on the milling machine;

(I) demonstrate various milling activities such as climb milling, conventional milling, slotting, grooving, cutting angles, and chamfering;

(J) write a detailed process plan, including appropriate feeds, speeds, tool selection, work holding methods, and sequencing for milling;

(K) develop a detailed milling part such as the NIMS Level 1 milling part; and

(L) employ basic preventative maintenance on the milling machine.

(9) The student employs skills necessary to perform work on various support equipment commonly found in a machine shop. The student is expected to:

(A) use various support equipment commonly found in a machine shop in a safe manner;

(B) understand basic pedestal grinder functions such as wheel selection criteria and requirements;

(C) understand basic sawing functions such as band type, speed, and feeds for various types of material;

(D) understand basic drill press operations, including work holding, appropriate speeds, and feeds; and

(E) use proper safety procedures for surface grinding operations.

Source: The provisions of this §127.817 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.818. Precision Metal Manufacturing II (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Precision Metal Manufacturing I. Recommended corequisite: Precision Metal Manufacturing II Lab. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Precision Metal Manufacturing II will provide students the knowledge, skills, and technologies required for employment in precision machining. While this course is designed to provide necessary skills in machining, it also provides a real-world foundation for any engineering discipline. This course addresses a variety of materials such as plastics, ceramics, and wood in addition to metal. Students will develop knowledge of the concepts and skills related to these systems to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for success. This course is designed to provide entry-level employment for the student or articulated credit integration into a community college and dual credit with a community college with completion of the advanced course.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:

(A) determine academic knowledge and skills required for postsecondary education;

(B) identify employers' expectations to foster positive customer satisfaction;

(C) demonstrate the standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;

(D) evaluate progress toward personal career goals;

(E) communicate effectively with others in the workplace to clarify objectives; and

(F) demonstrate skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(2) The student applies the technical knowledge and skills of advanced precision metal manufacturing. The student is expected to:

(A) apply the technical aspects found in The Machinery's Handbook resource; and

(B) select appropriate resources from the Internet as applied to manufacturing.

(3) The student builds on the manual machining skills gained in Precision Metal Manufacturing I. The student is expected to:

(A) develop a detailed turning part such as the National Institute for Metalworking Skills (NIMS) Level 1 turning, chucking, or turning between centers part with zero defects (100% to the print) in a safe manner; and

(B) develop a detailed milling part such as the NIMS Level 1 milling part with zero defects (100% to the print) in a safe manner.

(4) The student learns about standard computer numerical control (CNC) machinery. The student is expected to:

(A) research the history of numerical control machines;

(B) distinguish among different types of CNC machines used in the industry;

(C) demonstrate safety rules for CNC operation;

(D) demonstrate the methods by which programs can be entered into a controller; and

(E) use appropriate machining terminology to enhance CNC vocabulary.

(5) The student appraises various CNC systems to differentiate the development and implementation of those systems. The student is expected to:

(A) examine the types of drive motors used on CNC machinery;

(B) explain the Cartesian coordinate system;

(C) differentiate between absolute and incremental positioning; and

(D) illustrate the difference between datum and delta dimensioning.

(6) The student learns the process planning and tool selection within a CNC lab environment. The student is expected to:

(A) develop a detailed process plan, including proper tool selection, feeds, and speeds, for the material being cut and finish specifications on the engineering drawing, logical sequence of operations, and appropriate inspection points;

(B) develop a logical sequence of operations and appropriate inspection points;

(C) demonstrate use of carbide inserts; and

(D) apply various carbide inserts by determining the correct type, grade, style, feed, and speed for the most common materials machined in a basic machine shop.

(7) The student evaluates tool changing and tool offset registers in the CNC lab environment. The student is expected to:

(A) perform various types of tool changes;

(B) demonstrate quick change tooling used on CNC milling machines;

(C) demonstrate appropriate tool storage;

(D) demonstrate the proper use of tool offset registers;

(E) determine tool offset length; and

(F) incorporate tool offsets for a set up.

(8) The student operates a CNC lathe. The student is expected to:

(A) use equipment commonly associated with a CNC lathe in a safe manner;

(B) recognize, name, and describe the function of the primary components of a CNC lathe;

(C) perform preventative maintenance checks on a CNC lathe such as checking all fluid levels, system pressure, tooling wear, and component lubrication and cleaning;

(D) test the coolant for proper density and adjust accordingly in order to reach the correct mixture;

(E) perform a power up on a standard CNC lathe;

(F) demonstrate the use of the jog controls on the operator panel to jog the lathe's axes;

(G) demonstrate the ability to locate, assemble, and measure tooling according to work instructions and job documentation;

(H) install tools and tool holders in the automatic tool changer locations according to work instructions and job documentation;

(I) locate and set workpiece to zero on a CNC lathe;

(J) set any required work offsets for the part to be machined after a basic tool setting process has been completed;

(K) set the proper geometry/tool offsets for each tool in a standard tool setting process;

(L) operate a CNC lathe in automatic mode; and

(M) illustrate the proper power down process on a CNC lathe.

(9) The student operates a CNC mill. The student is expected to:

(A) use equipment commonly found on and around a CNC mill in a safe manner;

(B) recognize, name, and describe the function of the primary components of a CNC mill;

(C) perform preventative maintenance checks on a CNC mill such as checking all fluid levels, system pressure, tooling wear, and component lubrication and cleaning;

(D) test the coolant for proper density and adjust accordingly in order to reach the correct mixture;

(E) perform a power up on a standard CNC mill;

(F) demonstrate the use of the jog controls on the operator panel to jog the mill's axes;

(G) demonstrate the ability to locate, assemble, and measure tooling using a presetter or other means according to work instructions and job documentation;

(H) install tools and tool holders in the automatic tool changer locations according to work instructions and job documentation;

(I) locate and set workpiece to zero on a CNC mill;

(J) set any required work offsets for the part to be machined after a basic tool setting process has been completed;

(K) set the proper geometry/tool offsets for each tool in a standard tool-setting process;

(L) operate a CNC mill in automatic mode; and

(M) illustrate the proper power down process on a CNC mill.

(10) The student learns to manually program a CNC lathe without the help of computer-aided design or manufacturing (CAD/CAM) software. The student is expected to:

(A) calculate trigonometry to determine coordinates from technical drawings to cut arcs and angles;

(B) use trigonometry for determining cutter offsets;

(C) use appropriate mathematical skills to solve problems while programming a CNC lathe;

(D) write a simple program to face and turn;

(E) write a simple program to cut radiuses, angles, grooves, and threads;

(F) write a program using cutter radius compensation;

(G) write a program using canned cycles such as G71; and

(H) write a program and produce a complex part such as a NIMS Level 1 CNC lathe part with zero defects.

(11) The student learns to manually program a CNC mill (without the help of CAD/CAM software). The student is expected to:

(A) use trigonometry to determine coordinates from technical drawings to cut arcs and angles;

(B) use trigonometry for determining cutter offsets;

(C) use appropriate mathematical skills to solve problems while programming a CNC lathe;

(D) write a simple program to perform hole operations;

(E) write a simple program to cut radiuses and angles;

(F) write a program using cutter radius compensation and ramping; and

(G) write a program and produce a complex part such as a NIMS Level 1 CNC milling part with zero defects.

(12) The student develops a deeper understanding of quality control. The student is expected to:

(A) evaluate engineering drawings using geometric dimensioning and tolerancing;

(B) discuss the American Society of Mechanical Engineers (ASME) Y14.5M standard that defines geometric dimensioning and tolerancing; and

(C) appraise various quality control/management programs.

Source: The provisions of this §127.818 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.819. Precision Metal Manufacturing II Lab (One Credit), Adopted 2015.

(a) Implementation. The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(b) General requirements. This lab course is recommended for students in Grades 11 and 12. Prerequisite: Precision Metal Manufacturing I. Corequisite: Precision Metal Manufacturing II. This course must be taken concurrently with Precision Metal Manufacturing II and may not be taken as a stand-alone course. Districts are encouraged to offer this lab in a consecutive block with Precision Metal Manufacturing II to allow students sufficient time to master the content of both courses. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Precision Metal Manufacturing II Lab provides the knowledge, skills, and technologies required for employment in precision machining. While Precision Metal Manufacturing II Lab is designed to provide necessary skills in machining, it also provides a real-world foundation for any engineering discipline. This course may address a variety of materials such as plastics, ceramics, and wood in addition to metal. Students will develop knowledge of the concepts and skills related to these systems to apply them to personal and career development. This course supports integration of academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of

workplace skills prepare students for success. This course is designed to provide entry-level employment for the student or articulated credit integration into a community college and dual credit with a community college with completion of the advanced course.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) express ideas to others in a clear, concise, and effective manner through written and verbal communication;

(B) convey written information that is easily understandable to others;

(C) demonstrate acceptable work ethics in reporting for duty and performing assigned tasks as directed;

(D) conduct oneself in a manner acceptable for the profession and work site such as suitable dress and polite speech;

(E) choose the ethical course of action and comply with all applicable rules, laws, and regulations;

(F) review with a critical eye the fine, detailed aspects of both quantitative and qualitative work processes and end products;

(G) evaluate systems and operations; identify causes, problems, patterns, or issues; and explore workable solutions or remedies to improve situations;

(H) follow written and oral instructions and adhere to established business practices, policies, and procedures, including health and safety rules; and

(I) prioritize tasks, follow schedules, and work on goal-relevant activities in a way that uses time wisely in an effective, efficient manner.

(2) The student builds on the manual machining skills gained in Precision Metal Manufacturing I. The student is expected to:

(A) develop a detailed turning part such as the National Institute for Metalworking Skills (NIMS) Level 1 turning, chucking, or turning between centers part with zero defects (100% to the print) in a safe manner; and

(B) develop a detailed milling part such as the NIMS Level 1 milling part with zero defects (100% to the print) in a safe manner.

(3) The student evaluates tool changing and tool offset registers in a computer numerical control (CNC) lab environment. The student is expected to:

(A) perform various types of tool changes;

(B) demonstrate quick change tooling used on CNC milling machines;

(C) demonstrate appropriate tool storage;

(D) demonstrate the proper use of tool offset registers;

(E) determine tool offset length; and

(F) enter tool offsets for a set up.

(4) The student operates a CNC lathe. The student is expected to:

(A) use equipment commonly found on and around a CNC lathe in a safe manner;

(B) recognize, name, and describe the function of the primary components of a CNC lathe;

(C) perform preventative maintenance checks on a CNC lathe such as checking all fluid levels, system pressure, tooling wear, and component lubrication and cleaning;

(D) test the coolant for proper density and adjust accordingly in order to reach the correct mixture;

(E) perform a power up on a standard CNC lathe;

(F) demonstrate the use of the jog controls on the operator panel to jog the lathe's axes;

(G) demonstrate the ability to locate, assemble, and measure tooling according to work instructions and job documentation;

(H) install tools and tool holders in the automatic tool changer locations according to work instructions and job documentation;

(I) locate and set workpiece to zero on a CNC lathe;

(J) set any required work offsets for the part to be machined after a basic tool setting process has been completed;

(K) set the proper geometry/tool offsets for each tool in a standard tool setting process;

(L) operate a CNC lathe in automatic mode; and

(M) illustrate the proper power down process on a CNC lathe.

(5) The student operates a CNC mill. The student is expected to:

(A) use equipment commonly found on and around a CNC mill in a safe manner;

(B) recognize, name, and describe the function of the primary components of a CNC mill;

(C) perform preventative maintenance checks on a CNC mill such as checking all fluid levels, system pressure, tooling wear, and component lubrication and cleaning;

(D) test the coolant for proper density and adjust accordingly in order to reach the correct mixture;

(E) perform a power up on a standard CNC mill;

(F) demonstrate the use of the jog controls on the operator panel to jog the mill's axes;

(G) demonstrate the ability to locate, assemble, and measure tooling using a presetter or other means according to work instructions and job documentation;

(H) install tools and tool holders in the automatic tool changer locations according to work instructions and job documentation;

(I) locate and set workpiece to zero on a CNC mill;

(J) set any required work offsets for the part to be machined after a basic tool setting process has been completed;

(K) set the proper geometry/tool offsets for each tool in a standard tool setting process;

(L) operate a CNC mill in automatic mode; and

(M) illustrate the proper power down process on a CNC mill.

(6) The student learns to manually program a CNC lathe without the help of computer-aided design or manufacturing (CAD/CAM) software. The student is expected to:

(A) use trigonometry to determine coordinates from technical drawings to cut arcs and angles;

(B) use trigonometry for determining cutter offsets;

(C) use appropriate mathematical skills to solve problems while programming a CNC lathe;

(D) write a simple program to face and turn;

(E) write a simple program to cut radiuses, angles, grooves, and threads;

(F) write a program using cutter radius compensation;

(G) write a program using canned cycles such as G71; and

(H) write a program and produce a complex part such as a NIMS Level 1 CNC lathe part with zero defects.

(7) The student learns to manually program a CNC mill (without the help of CAD/CAM software). The student is expected to:

(A) use trigonometry to determine coordinates from technical drawings to cut arcs and angles;

(B) use trigonometry to determine cutter offsets;

(C) use appropriate mathematical skills to solve problems while programming a CNC lathe;

(D) write a simple program to perform hole operations;

(E) write a simple program to cut radiuses and angles;

(F) write a program using cutter radius compensation and ramping; and

(G) write a program and produce a complex part such as a NIMS Level 1 CNC milling part with zero defects.

Source: The provisions of this §127.819 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.820. Introduction to Welding (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 9-12. Recommended prerequisite or corequisite: Algebra I. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Introduction to Welding will provide an introduction to welding technology with an emphasis on basic welding laboratory principles and operating procedures. Students will be introduced to the

three basic welding processes. Topics include: industrial safety and health practices, hand tool and power machine use, measurement, laboratory operating procedures, welding power sources, welding career potentials, and introduction to welding codes and standards. Introduction to Welding will provide students with the knowledge, skills, and technologies required for employment in welding industries. Students will develop knowledge and skills related to welding and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills will prepare students for future success.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student explores the characteristics of a successful worker in the global economy. The student is expected to:

(A) determine academic knowledge and skills required for postsecondary education;

(B) identify employers' expectations to foster positive customer satisfaction;

(C) demonstrate the professional standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;

(D) evaluate progress toward personal career goals;

(E) communicate effectively with others in the workplace to clarify objectives; and

(F) apply knowledge and skills to health and safety in the workplace as specified by appropriate governmental regulations.

(2) The student evaluates the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to:

(A) employ welding equipment according to safety standards;

(B) identify and properly dispose of environmentally hazardous materials used in welding;

(C) explain the importance of recycling materials used in welding;

(D) choose appropriate personal protective equipment; and

(E) evaluate skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(3) The student compares and contrasts welding joint design, material symbols, and welds. The student is expected to:

(A) demonstrate knowledge of welding sketches; and

(B) identify types of welds such as fillet, groove, spot, plug, and flanged.

(4) The student applies academic skills in relationship to welding. The student is expected to:

(A) demonstrate mathematical skills related to welding;

(B) demonstrate technical writing skills related to welding;

(C) apply accurate readings of measuring devices;

(D) accurately use appropriate tools to make measurements;

(E) solve problems using whole numbers, fractions, mixed numbers, and decimals;

(F) perform conversions between fractions and decimals; and

(G) perform conversions between standard units and metric units.

(5) The student applies the concepts and skills of welding projects. The student is expected to:

(A) explore careers in welding;

(B) understand welding codes such as American Petroleum Institute (API) 1104 and American Welding Society (AWS) D1.1;

(C) work independently to fabricate a variety of welded projects with minimal assistance; and

(D) work collaboratively with other students.

(6) The student performs oxy-fuel cutting processes on carbon steels. The student is expected to:

(A) use safe operating practices;

(B) perform safe handling of compressed gases;

(C) identify components of oxy-fuel gas cutting;

(D) demonstrate proper set-up procedures for the oxy-fuel process;

(E) identify the factors affecting the oxy-fuel cutting of base metals; and

(F) demonstrate proper cutting techniques such as piercing, straight line, and bevel;

(7) The student performs shielded metal arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) demonstrate knowledge of welding currents;

(C) apply shielded metal arc welding principles;

(D) demonstrate proper set-up procedure for shielded metal arc welding;

(E) determine appropriate electrodes for base metal in shielded metal arc welding;

(F) perform fillet and groove welds in all positions; and

(G) prepare joints for welding.

(8) The student performs gas metal arc welding principles and practices. The student is expected to:

(A) use safe operating practices;

(B) apply gas metal arc welding principles;

(C) demonstrate proper set-up procedure for gas metal arc welding;

(D) use appropriate equipment setup for base metal in gas metal arc welding; and

(E) perform fillet and groove welds using gas metal arc welding with various metal transfer processes.

Source: The provisions of this §127.820 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.821. Welding I (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Algebra I, Principles of Manufacturing, Introduction to Precision Metal Manufacturing, or Introduction to Welding. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Welding I provides the knowledge, skills, and technologies required for employment in metal technology systems. Students will develop knowledge and skills related to this system and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:

(A) explore academic knowledge and skills required for postsecondary education;

(B) identify employers' expectations to foster positive customer satisfaction;

(C) demonstrate the professional standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;

(D) evaluate personal career goals;

(E) communicate effectively with others in the workplace to clarify objectives; and

(F) demonstrate skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(2) The student applies academic skills to the requirements of welding. The student is expected to:

(A) demonstrate effective communication skills with individuals from varied cultures such as fellow workers, management, and customers;

(B) demonstrate mathematical skills to estimate costs;

(C) demonstrate technical writing skills related to work orders;

(D) apply accurate readings of measuring devices;

(E) use appropriate tools to make accurate measurements;

(F) compute measurements such as area, surface area, volume, and perimeter;

(G) solve problems using whole numbers, fractions, mixed numbers, and decimals;

(H) use various methods, including a calculator, to perform computations;

(I) perform conversions between fractions and decimals;

(J) perform conversions between standards units and metric units;

(K) calculate and apply the functions of angles such as using the Pythagorean Theorem; and

(L) diagram the parts of a circle.

(3) The student evaluates the function and application of the tools, equipment, technologies, and materials used in welding. The student is expected to:

(A) operate welding equipment according to safety standards;

(B) identify and properly dispose of environmentally hazardous materials used in welding;

(C) explain the importance of recycling materials used in welding;

(D) choose appropriate personal protective equipment; and

(E) evaluate skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(4) The student understands welding joint design, symbols, and welds. The student is expected to:

(A) demonstrate knowledge of engineering drawings, charts, and diagrams;

(B) interpret orthographic and isometric views of three-dimensional figures;

(C) interpret engineering, drawings, charts, and diagrams;

(D) analyze components of the welding symbol;

(E) identify types of welding joints;

(F) identify positions of welding; and

(G) identify types of welds such as fillet, groove, spot, plug, and flanged.

(5) The student analyzes the concepts and intricacies of inspections and related codes. The student is expected to:

(A) explain weld inspection processes; and

(B) interpret welding codes.

(6) The student analyzes oxy-fuel cutting processes on carbon steels. The student is expected to:

(A) practice safe operating practices;

(B) perform safe handling of compressed gases;

(C) identify components of oxy-fuel gas cutting system;

(D) demonstrate proper set-up procedures for oxy-fuel cutting process;

(E) identify factors affecting oxy-fuel cutting of base metals;

(F) demonstrate proper cutting techniques such as piercing, straight line, and bevel;

(G) identify acceptable cuts; and

(H) evaluate alternative fuel gasses such as propane, propylene, and Chemtane 2®.

(7) The student analyzes plasma arc cutting on metals. The student is expected to:

(A) use safe operating practices;

(B) demonstrate knowledge of the theories of plasma arc cutting;

(C) apply safe handling of compressed air supply;

(D) identify components of plasma arc cutting;

(E) demonstrate correct set-up procedure for plasma arc cutting;

(F) define cutting terms; and

(G) perform straight line, piercing, bevels, and shape cuts.

(8) The student analyzes shielded metal arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) analyze welding current relationships such as alternating current and direct current, heat transfer, and polarity;

(C) apply shielded metal arc welding principles;

(D) demonstrate proper set-up procedure for shielded metal arc welding;

(E) explain the American Welding Society (AWS) identification system for shielded metal arc welding electrodes;

(F) determine appropriate electrodes for base metal in shielded metal arc welding; and

(G) perform multi-pass groove welds in all positions according to industry-accepted welding standards.

(9) The student analyzes gas metal arc welding principles and practices. The student is expected to:

(A) use safe operating practices;

(B) explain the effects that weld angle, work angle, and electrode extension have on welds;

(C) apply gas metal arc welding principles;

(D) demonstrate proper set-up procedure for gas metal arc welding;

(E) explain the AWS identification system for gas metal arc welding filler metal;

(F) determine appropriate filler metal for base metal in gas metal arc welding; and

(G) perform fillet and groove welds in all positions.

(10) The student analyzes flux cored arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) explain the effects that weld angle, work angle, and electrode extension have on welds;

(C) apply flux cored arc welding principles;

(D) demonstrate proper set-up procedure for flux cored arc welding;

(E) explain the AWS identification system for flux cored arc welding electrodes;

(F) determine appropriate filler metal for base metal in flux cored arc welding; and

(G) perform fillet and groove welds in all positions.

(11) The student analyzes gas tungsten arc welding on metals. The student is expected to:

(A) use safe operating practices;

(B) analyze electrical welding current relationships such as alternating current and direct current, heat transfer, and polarity;

(C) identify the common types of tungsten and filler metals according to the AWS identification system;

(D) demonstrate proper set-up procedure for gas tungsten arc welding;

(E) perform fillet and groove welds in all positions; and

(F) perform welds on metals such as carbon steel, stainless steel, and aluminum.

Source: The provisions of this §127.821 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.822. Welding II (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Welding I. Recommended prerequisites: Algebra I or Geometry. Recommended corequisite: Welding II Lab. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Welding II builds on the knowledge and skills developed in Welding I. Students will develop advanced welding concepts and skills as related to personal and career development. Students will integrate academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:

(A) determine academic knowledge and skills required for postsecondary education;

(B) identify employers' expectations to foster positive customer satisfaction;

(C) demonstrate the professional standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;

(D) evaluate progress toward personal career goals;

(E) communicate effectively with others in the workplace to clarify objectives; and

(F) apply knowledge and skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(2) The student applies academic skills to the requirements of welding. The student is expected to:

(A) demonstrate mathematical skills to estimate costs;

(B) explain the impact of accurate readings of measuring devices on cost estimates;

(C) justify the selection of a tool to make accurate measurements;

(D) compute measurements such as area, surface area, volume, and perimeter;

(E) solve problems using whole numbers, fractions, mixed numbers, and decimals;

(F) apply right triangle relationships using the Pythagorean Theorem; and

(G) select a mathematical formula for estimation.

(3) The student knows the functions and applications of the tools, equipment, technologies, and materials used in welding. The student is expected to:

(A) use welding equipment according to safety standards;

(B) dispose of environmentally hazardous materials used in welding;

(C) explain the importance of recycling materials used in welding;

(D) evaluate the performance impact of emerging technologies in welding;

(E) use appropriate personal protective equipment to follow safety measures; and

(F) investigate the use of automated welding machines such as numerical control, computer numerical control, and robotics-controlled welding machines.

(4) The student illustrates welding joint design, symbols, and welds. The student is expected to:

(A) use knowledge of engineering drawings to complete an advanced project; and

(B) evaluate projects using engineering drawing specifications.

(5) The student applies the concepts and skills of welding to perform tasks. The student is expected to:

(A) work independently in fabricating welded projects;

(B) work collaboratively with other students to complete a real-world application item; and

(C) troubleshoot equipment.

(6) The student analyzes the concepts and intricacies of inspections related to welding codes. The student is expected to:

(A) inspect the welding projects of team members;

(B) select codes for weld inspections; and

(C) critique and evaluate the weldments of team members.

(7) The student performs advanced cutting processes on carbon steels. The student is expected to:

(A) observe safe operating practices;

(B) apply safe handling of compressed gases; and

(C) perform cutting processes according to accepted welding standards.

(8) The student performs shielded metal arc welding on metals. The student is expected to:

(A) employ safe operating practices; and

(B) demonstrate skills required to make welds in all positions according to industry-accepted welding standards.

(9) The student performs flux cored metal arc welding. The student is expected to:

(A) use safe operating practices;

(B) perform fillet and groove welds; and

(C) perform welds in all appropriate positions according to industry-accepted welding standards.

(10) The student performs gas tungsten arc welding on metals. The student is expected to:

(A) employ safe operating practices;

(B) perform fillet and groove welds in all positions; and

(C) perform welds on metals such as carbon steel, stainless steel, pipe, and aluminum according to industry-accepted welding standards.

Source: The provisions of this §127.822 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.823. Welding II Lab (One Credit), Adopted 2015.

(a) Implementation. The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(b) General requirements. This lab course is recommended for students in Grades 11 and 12. Prerequisite: Welding I. Corequisite: Welding II. This course must be taken concurrently with Welding II and may not be taken as a stand-alone course. Districts are encouraged to offer this course in a consecutive block with Welding II to allow students sufficient time to master the content of both courses. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Welding II Lab provides an introduction to welding technology with an emphasis on basic welding laboratory principles and operating procedures. Topics include: industrial safety and health practices, hand tool and power machine use, measurement, laboratory operating procedures, welding power sources, welding career potentials, and introduction to welding codes and standards. This course provides knowledge, skills, and technologies required for employment in welding industries. Students will develop knowledge and skills related to this system and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) express ideas to others in a clear, concise, and effective manner through written and verbal communication;

(B) convey written information that is easily understandable to others;

(C) demonstrate acceptable work ethics in reporting for duty and performing assigned tasks as directed;

(D) conduct oneself in a manner acceptable for the profession and work site such as suitable dress and polite speech;

(E) choose the ethical course of action and comply with all applicable rules, laws, and regulations;

(F) review the fine, detailed aspects of both quantitative and qualitative work process and end products;

(G) evaluate systems and operations; identify causes, problems, patterns, or issues; and explore workable solutions or remedies to improve situations;

(H) follow written and oral instructions and adhere to established business practices, policies, and procedures, including health and safety rules; and

(I) prioritize tasks, follow schedules, and work toward goal-relevant activities in an effective, efficient manner.

(2) The student demonstrates the functions and applications of the tools, equipment, technologies, and metals used in code welding. The student is expected to:

(A) use welding equipment according to safety standards;

(B) identify and properly dispose of environmentally hazardous materials used in welding;

(C) explain the importance of recycling materials used in welding; and

(D) use appropriate personal protective equipment.

(3) The student applies the concepts and skills of welding of actual work situations. The student is expected to:

(A) work independently to fabricate welded projects with minimal assistance;

(B) work collaboratively with other students to complete relevant projects; and

(C) troubleshoot equipment.

(4) The student analyzes the concepts and intricacies of inspections and related codes. The student is expected to:

(A) explain weld inspection processes; and

(B) produce acceptable weldments to standards related to industry codes such as the American Welding Society (AWS), American National Standards Institute, and Canadian Welding Bureau.

(5) The student performs oxy-fuel cutting processes. The student is expected to:

(A) use safe operating practices;

(B) perform safe handling of compressed gases;

(C) assemble components involved in setting up for oxy-fuel gas cutting processes;

(D) demonstrate proper set-up for cutting techniques such as piercing, straight line, and bevel; and

(E) evaluate acceptable and unacceptable cuts.

(6) The student performs plasma arc cutting on metals. The student is expected to:

(A) use safe operating practices;

(B) explain the difference between safe and unsafe storage and handling of compressed gas supply;

(C) employ proper set-up procedures for plasma arc cutting; and

(D) demonstrate proper cutting techniques, including straight line, piercing, and bevels.

(7) The student performs shielded metal arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) demonstrate shielded metal arc welding principles;

(C) demonstrate proper set-up procedures for shielded metal arc welding;

(D) select appropriate electrodes for base metal in shielded metal arc welding;

(E) perform welds such as fillet and groove according to industry-accepted welding standards;

(F) perform multiple pass welds;

(G) prepare joints for welding; and

(H) explain heating processes such as pre-heating and post-heating.

(8) The student demonstrates proper set-up procedure for gas metal arc welding. The student is expected to:

(A) use safe operating practices;

(B) demonstrate gas metal arc welding principles;

(C) demonstrate proper set-up for gas metal arc welding;

(D) select appropriate filler metals for base metal in gas metal arc welding; and

(E) perform fillet and groove welds in all positions according to industry-accepted welding standards.

(9) The student performs flux cored arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) employ and appraise flux cored arc welding principles;

(C) demonstrate proper set-up procedures for flux cored arc welding;

(D) appraise appropriate filler metal for base metal in flux cored arc welding;

(E) perform fillet and groove welds; and

(F) perform welds in all appropriate positions according to industry-accepted welding standards.

(10) The student performs gas tungsten arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) demonstrate gas tungsten arc welding principles;

(C) demonstrate proper set-up for gas tungsten arc welding;

(D) select appropriate use of filler metals for base metal in gas tungsten arc welding; and

(E) perform welds in all appropriate positions according to industry-accepted welding standards.

(11) The student performs weldment fabrications. The student is expected to:

(A) identify layout tools;

(B) perform a part layout on plate according to a blueprint;

(C) perform a layout of a pipe fitting according to a blueprint; and

(D) perform an assembly according to a blueprint.

Source: The provisions of this §127.823 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.824. Blueprint Reading for Manufacturing Applications (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2026-2027 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 9-12. Recommended prerequisites: Algebra I and Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Blueprint Reading for Manufacturing Applications, students gain knowledge and skills in an introduction to reading and interpreting working drawings for basic machining processes, mechanical maintenance, basic electrical, basic fluid power, and basic facility prints. Students also use sketching techniques to create pictorial and multiple-view drawings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student demonstrates an understanding of blueprint and technical drafting terminology and functions. The student is expected to:

(A) explain the function of various parts of a title block such as scale, materials, and print title;

(B) interpret and explain the function of multi-view drawings;

(C) describe fractional, decimal, and metric dimensions used in technical drawings;

(D) interpret and explain the function of section views;

(E) identify and describe projection methods, including isometric, oblique, and orthographic, used in engineering drawings;

(F) explain the function of auxiliary views;

(G) identify and explain types of dimensions, including linear, radial, angular, ordinate, and arc length;

(H) explain the function of pictorial drawings in manufacturing applications;

(I) explain the function of geometric dimensioning and tolerancing in manufacturing applications;

(J) explain tolerances with parts from a print;

(K) explain the function of scaling in a print;

(L) differentiate between a pictorial and a schematic drawing;

(M) explain the function of call outs in a print; and

(N) differentiate between electrical schematics, fluid power schematics, and piping and instrumentation diagram (P&ID) drawings.

(2) The student demonstrates an understanding of tools and symbols to produce technical schematics, facility prints, P&ID prints, and blueprints. The student is expected to:

(A) explain the function of and use a compass for drawing arcs in a print;

(B) explain the function of and use measuring devices such as scales, micrometers, and dial calipers;

(C) explain and demonstrate basic functions of computer-aided design and drafting (CADD) software;

(D) identify blueprint symbols, including surface profile, position, run out, countersink, and depth symbols;

(E) differentiate between driving and reference dimensions;

(F) identify basic electrical print symbols, including switch, lamp, relay, and contact symbols;

(G) identify basic fluid power print symbols, including power unit, actuator, directional control valve, and flow control symbols;

(H) identify various P&ID symbols, including valve, gauge, meter, and regulator symbols; and

(I) identify symbols for components, including threads, fasteners, and springs, used in the manufacturing process.

(3) The student interprets facility drawings related to manufacturing buildings. The student is expected to:

(A) interpret and explain floor plan drawings;

(B) interpret and explain elevation drawings;

(C) interpret and explain section views and details;

(D) locate electrical components, including distribution panels, lights, switches, and outlets, on facility drawings;

(E) identify plumbing components, including drains, water supply, and boilers, on facility drawings; and

(F) identify heating, ventilation, and air conditioning (HVAC) components, including condensers, evaporators, and plenum, in facility drawings.

(4) The student applies drafting principles to create sketch pictorials and construct multi-view drawings. The student is expected to:

(A) sketch auxiliary projected views, including inclined and oblique surfaces, in pictorial drawings;

(B) create a sketch using multi-views; and

(C) annotate a series of multi-view projections using proper dimensioning standards.

(5) The student demonstrates knowledge of tolerances as applied to technical drawings and prints. The student is expected to:

(A) illustrate and explain how bilateral and unilateral tolerances are expressed in drawings; and

(B) calculate tolerances for mating parts based on maximum material conditions, tolerance stacking, and allowance.

(6) The student demonstrates knowledge of revision information related to drawings. The student is expected to:

(A) describe standard drawing practices such as title blocks, revision history, and change orders for drawing revisions;

(B) apply standard drawing practices to revise technical drawings, ensuring accuracy and compliance with industry standards; and

(C) apply revision information, including date of revision, description of changes, and approval signatures, to mechanical and electrical industrial prints.

Source: The provisions of this §127.824 adopted to be effective February 24, 2026, 51 TexReg 1124.

§127.828. Industrial Maintenance (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2026-2027 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Industrial Maintenance is designed to introduce students to knowledge and skills used in the proper application of industrial maintenance. The study of manufacturing technology allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of relevant

maintenance tasks. Students gain an understanding of what employers require to gain and maintain employment in manufacturing careers.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies mechanical skills to maintain and repair industrial equipment using the appropriate tools and equipment while adhering to safety policies. The student is expected to:

(A) identify equipment malfunctions using visual, audible, and other sensory inspection skills to detect issues such as lack of lubrication, misalignment, excess wear, vibration, and over-temperature;

(B) differentiate between mechanical, hydraulic, pneumatic, and electrical systems;

(C) identify safety concerns with equipment maintenance such as dangers with rotating equipment, hot surfaces from operating equipment, potential for shock from electrical power cords and grounding, and sharp surfaces from equipment wear;

(D) create a safe plan of action to address safety concerns for an industrial training environment such as sparks, metal shavings, and electrical shock hazards;

(E) identify tools and describe procedures used in cutting, drilling, cleaning, and abrasive processes;

(F) explain safety practices for various types of manufacturing tools used for cutting, drilling, cleaning, and abrasive processes;

(G) identify and demonstrate proper use of precision measuring tools, including micrometers, dial calipers, and scales, to verify proper repair and alignment; and

(H) identify and explain the applications such as material and fastener strength for various types of fasteners such as bolts, screws, washers, and nuts.

(2) The student applies communication and documentation skills to manufacturing activities. The student is expected to:

(A) compose written and oral technical communication such as maintenance plans, equipment breakdowns, and repair part ordering in a clear, concise, and effective manner for a variety of purposes and audiences;

(B) identify documentation methods such as maintenance logbooks and checklists for maintenance tasks and plans; and

(C) develop and execute a plan for maintenance task completion such as equipment lubrication, filter changes, and equipment visual checks.

(3) The student maintains and repairs industrial equipment using the appropriate tools, equipment, machines, materials, and technical processes. The student is expected to:

(A) describe the processes needed to complete a project, including initiating, planning, executing, monitoring, controlling, and closing;

(B) use appropriate tools to complete maintenance repair processes, including drilling, tapping, layout, and tightening fasteners to spec; and

(C) use various wrenches such as open and box end wrenches, filter wrenches, and adjustable pliers to disassemble filter housings to change filters and fluids.

(4) The student understands the foundations of occupational safety and health. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations;

(C) explain and discuss how OSHA inspections are conducted;

(D) explain and discuss the role of national and state safety and health regulatory entities;

(E) explain types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic, and explain the role industrial hygiene plays in occupational safety;

(F) discuss the importance of safe walking and working surfaces and best practices for preventing or reducing slips, trips, and falls in the workplace;

(G) describe types of electrical hazards in the workplace;

(H) describe control methods to prevent electrical hazards in the workplace;

(I) analyze the hazards of handling, storing, using, and transporting hazardous materials;

(J) discuss ways to reduce exposure to hazardous materials in the workplace;

(K) identify workplace health and safety resources, including emergency plans, and discuss how these resources are used to make decisions in the workplace;

(L) describe elements of a safety and health program, including management leadership, worker participation, and education and training;

(M) explain the purpose and importance of written emergency action and fire protection plans;

(N) describe key components of evacuation plans, emergency exit routes, and fire hazards lists;

(O) explain the role of emergency personnel within an organization;

(P) explain components of a hazard communication program; and

(Q) explain and provide examples of safety and health training requirements specified by standard setting organizations.

(5) The student examines safe work habits in an industrial maintenance setting. The student is expected to:

(A) identify and describe proper storage and disposal procedures for hazardous materials using Safety Data Sheets (SDS);

(B) identify and demonstrate use of proper personal protective equipment (PPE) and safety requirements in the manufacturing industry such as hearing protection, eye protection, and gloves;

(C) describe and demonstrate proper lockout/tagout procedures;

(D) describe and demonstrate safe operation of power tools, including drills, saws, grinders, and sanders; and

(E) identify and select appropriate PPE needed to operate various power tools, including drills, saws, grinders, and sanders.

(6) The student examines the importance of preventative maintenance in an industrial maintenance environment. The student is expected to:

(A) perform preventative maintenance (PM), including lubrication, cleaning of parts, and tightening of fasteners, on equipment such as motors, gearboxes, chain drives, and conveyors;

(B) determine a PM schedule based on data collected from machine breakdowns, including frequency of failures, types of malfunctions, and repair times; and

(C) differentiate between reactive maintenance such as breakdown repairs, preventative maintenance such as lubrication, and predictive maintenance such as planning repairs based on previous breakdown frequencies.

(7) The student examines career opportunities and educational requirements in manufacturing and technology. The student is expected to:

(A) identify special skill career pathways in manufacturing such as maintenance technician, engineer, designer, and automation technician;

(B) identify and explain the importance of industry networking opportunities such as career or job fairs; and

(C) describe the roles and functions of engineers, technologists, and technicians in an industrial maintenance setting.

Source: The provisions of this §127.828 adopted to be effective February 24, 2026, 51 TexReg 1124.

§127.829. Mechanical Maintenance (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2026-2027 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Manufacturing Career Cluster. Recommended prerequisite: Algebra I or Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Mechanical Maintenance is designed to introduce students to knowledge and skills used in the proper application of mechanical maintenance. The study of mechanical maintenance and hands-on application allows students to reinforce, apply, and transfer academic knowledge and skills to a variety of relevant activities. Students gain an understanding of what employers require to gain and maintain employment in manufacturing careers and potential hazards faced by the maintenance technician in an industrial setting.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student understands the foundations of occupational safety and health. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations;

(C) explain and discuss the importance of how OSHA inspections are conducted;

(D) explain and discuss the role of national and state regulatory entities;

(E) explain the role industrial hygiene plays in occupational safety and explain types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(F) discuss the importance of safe walking and working surfaces in the workplace;

(G) discuss best practices for preventing or reducing slips, trips, and falls in the workplace;

(H) describe types of electrical hazards in the workplace and the risks associated with these hazards;

(I) describe control methods to prevent electrical hazards in the workplace;

(J) analyze the hazards of handling, storing, using, and transporting hazardous materials;

(K) identify and discuss ways to reduce exposure to hazardous materials in the workplace;

(L) identify workplace health and safety resources, including emergency plans, and discuss how these resources are used to make decisions in the workplace;

(M) describe elements of a safety and health program, including management leadership, worker participation, and education and training;

(N) explain the purpose and importance of written emergency action plans and fire protection plans;

(O) describe key components of evacuation plans, emergency exit routes, fire hazards lists;

(P) explain the role of emergency personnel within an organization;

(Q) explain components of a hazard communication program; and

(R) explain and provide examples of safety and health training requirements specified by standard setting organizations such as OSHA and industrial companies.

(2) The student demonstrates safe work habits while performing mechanical activities in a mechanical maintenance setting. The student is expected to:

(A) identify and describe proper storage and disposal procedures for hazardous materials using Safety Data Sheets (SDS);

(B) identify and demonstrate use of proper personal protective equipment (PPE), including ear plugs, safety glasses, dust masks, and respirators, in the manufacturing industry;

(C) describe and demonstrate proper lockout/tagout procedures;

(D) describe and demonstrate safe operation of hand tools needed for disassembly and reassembly of mechanical parts; and

(E) identify and select appropriate PPE needed to operate various hand tools, including gloves for protection from pinch points, sharp edges, and hot surfaces.

(3) The student examines the operation of various pumps. The student is expected to:

(A) identify components of a centrifugal pump, including vane, internal seals, and bearings;

(B) identify components of a positive displacement piston pump, including rings, seals, pistons, and crankshaft;

(C) identify components of a positive displacement diaphragm pump, including diaphragm, check valves, and internal seals;

(D) explain the function of a pressure tank and effects on flow with a diaphragm pump;

(E) explain and demonstrate how to fill a suction line to prime a pump;

(F) identify components of a check valve in pumps; and

(G) explain the function of a check valve in maintaining pump priming by preventing back flow and ensuring fluid flow.

(4) The student examines the operation of various compressors. The student is expected to:

(A) identify components of compressors, including the piston, crankshaft, and cylinders, and explain how these components work together to compress air or other gases;

(B) explain the operation of a piston compressor and how the components work together to increase pressure;

(C) differentiate between a single-stage and two-stage piston compressor;

(D) identify and explain the function of intercoolers in two-stage piston compressors;

(E) identify and explain the function of after coolers in two-stage piston compressors;

(F) identify components of a rotary screw compressor, including screws, compression chamber, intake valves, and discharge valves;

(G) explain the operation of a rotary screw compressor and how the components work together to increase pressure; and

(H) explain the importance of dryers with industrial compressors, including how dryers prevent corrosion, improve efficiency, and extend equipment lifespan.

(5) The student analyzes test or performance data to assess equipment operation. The student is expected to:

(A) inspect equipment parts, including bearings, bolts, housing, and shafts, to identify typical defects such as breakage or excessive wear;

(B) observe equipment in operation to check for potential problems such as leaks, misalignment, and overheating; and

(C) test mechanical equipment to ensure proper functioning of equipment after replacement or repair of parts.

(6) The student uses prints, specifications, and diagrams to perform installation, disassembly, and assembly of mechanical systems. The student is expected to:

(A) identify components of pumps, compressors, and mechanical drives in mechanical drawings and diagrams;

(B) apply torque to fasteners as prescribed in equipment manuals during reassembly;

(C) identify input and output capability of pumps and compressors according to manufacturer specifications;

(D) identify input and output speed and torque capability of belt, chain, and gear driven mechanical drives systems according to manufacturer specifications;

(E) locate part numbers using a diagram; and

(F) use a logbook or computer to record information about parts, materials, and repair procedures.

(7) The student uses industrial maintenance skills to safely disassemble and assemble various types of pumps for the purpose of maintenance and repair. The student is expected to:

(A) identify safety hazards, including electrical, mechanical, and thermal risks, associated with assembly and disassembly of pumps;

(B) explain the purpose of lockout/tagout procedures for pumps to reduce electrical, mechanical, and thermal hazards;

(C) identify tools and describe procedures used in the disassembly and assembly of a centrifugal pump;

(D) identify tools and describe procedures used in the disassembly and assembly of a diaphragm pump;

(E) inspect pumps to locate damage, defects, and wear;

(F) operate pumps to ensure correct function such as rotation direction, prime, and flow;

(G) explain and demonstrate proper lubrication procedures for pumps; and

(H) use a logbook or computer to record information about parts, materials, and repair procedures.

(8) The student uses industrial maintenance skills to safely disassemble and assemble various types of compressors for the purpose of maintenance and repair. The student is expected to:

(A) identify safety hazards, including electrical, mechanical, and thermal risks, associated with assembly and disassembly of compressors;

(B) explain the purpose of lockout/tagout procedures for compressors to reduce electrical, mechanical, and thermal hazards;

(C) identify tools and describe procedures used in the disassembly and assembly of a reciprocating compressor;

(D) identify tools and describe procedures used in the disassembly and assembly of a rotary screw compressor;

(E) inspect compressors to locate damage, defects, and wear;

(F) operate newly reassembled compressor to ensure correct function such as direction of rotation;

(G) explain and demonstrate proper lubrication procedures for compressors; and

(H) use a logbook or computer to record information about parts, materials, and repair procedures.

(9) The student examines and recognizes internal components of various pumps and compressors. The student is expected to:

(A) identify internal seals and vanes in various compressors and pumps, including centrifugal, vane, and diaphragm pumps;

(B) inspect vanes in a centrifugal pump for wear and damage;

(C) inspect internal seals in pumps and compressors for wear and damage;

(D) inspect diaphragm for damage, defects, and wear;

(E) identify bearings on pumps and compressors; and

(F) inspect bearings on pumps and compressors for damage and wear.

(10) The student understands the purpose of specific internal components of various pumps and compressors. The student is expected to:

(A) explain the purpose of internal seals on compressors and pumps;

(B) explain the function and operation of bearings on compressors and pumps;

(C) identify and explain the function of check valves in a diaphragm pump; and

(D) explain lubrication requirements for pumps and compressors.

(11) The student understands the purpose of specific internal components of gear boxes. The student is expected to:

(A) identify and explain the function of spur gears in mechanical drive systems;

(B) identify and explain the function of helical gears in mechanical drive systems;

(C) identify and explain the function of miter and bevel gears in mechanical drive systems;

(D) differentiate between miter and bevel gears in mechanical drive systems; and

(E) identify and explain the function of slingers for lubrication distribution in mechanical drive systems.

(12) The student applies industrial maintenance skills to safely disassemble and assemble various types of mechanical drives. The student is expected to:

(A) identify tools and describe procedures used in the disassembly and assembly of belt, chain, and gear driven mechanical drives; and

(B) identify safety hazards associated with assembly and disassembly of belt, chain, and gear driven mechanical drives.

(13) The student understands the use of drive belts and chains for speed control. The student is expected to:

(A) identify belt style, size, and application on a mechanical drive system to meet speed and torque specifications;

(B) identify proper sheave for belt application on a mechanical drive system;

(C) differentiate between a drive and driven sheave in mechanical drive systems;

(D) calculate sheave ratios for speed adjustments on a mechanical drive system;

(E) inspect sheave and belt for wear and possible replacement on a mechanical drive system;

(F) identify drive chain size to match sprocket used on a mechanical drive system;

(G) calculate sprocket ratios for speed adjustments on a mechanical drive system;

(H) adjust chain length by breaking roller chain with special chain breaking tools;

(I) assemble a chain on a mechanical drive system according to length and tension requirements; and

(J) inspect sprocket and chain for wear and possible replacement on a mechanical drive system.

(14) The student examines career opportunities and educational requirements in manufacturing and technology. The student is expected to:

(A) identify special skill career pathways in manufacturing such as an industrial maintenance technician, mechanical installer, mechanical repair, and mechanical troubleshooter;

(B) identify and explain the importance of industry networking opportunities such as career or job fairs; and

(C) describe the roles and functions of an industrial maintenance technician in manufacturing.

Source: The provisions of this §127.829 adopted to be effective February 24, 2026, 51 TexReg 1124.

§127.830. Basic Fluid Power (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2026-2027 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Manufacturing Career Cluster. Recommended prerequisites: Algebra I and Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) In Basic Fluid Power, students gain knowledge and skills in hydraulic and pneumatic systems as applied to industrial manufacturing. Instruction includes terminology and fluid power theory, interpreting technical drawings, component identification, mathematical calculations as applied to fluid power systems, and component functions. Students gain basic knowledge of fluid power system design with basic system components, installing basic fluid power system components, and building maintenance schedules for preventative and reactive maintenance.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student examines career opportunities and safety concerns in the manufacturing industry. The student is expected to:

(A) research and describe trends of manufacturing careers in industry; and

(B) identify safety, health, environmental, and ergonomic issues in the manufacturing industry.

(2) The student examines terminology and fundamental concepts of fluid power in manufacturing. The student is expected to:

(A) explain the function of Pascal's Law in hydraulic systems;

(B) identify and explain the function of actuators in fluid power systems;

(C) identify and explain the function of valves in fluid power systems;

(D) describe the relationship between pressure, force, and cylinder volume in fluid power systems;

(E) analyze the application of Gay Lussac's Law, Charles's Law, and Boyle's Law in pneumatic systems;

(F) explain how the law of conservation of energy applies to specific fluid power systems, including hydraulic and pneumatic systems;

(G) explain how pressure is generated in a fluid power circuit;

(H) explain how different seal types and operating temperatures can impact fluid compatibility;

(I) explain the difference between flash point, fire point, and auto ignition regarding hydraulic fluid;

(J) explain displacement regarding hydraulic pumps; and

(K) identify specific hazards such as high-pressure injection injuries and equipment damage resulting from unrelieved pressure in the lines of a fluid power system.

(3) The student reads and interprets technical drawings in a fluid power system. The student is expected to:

(A) identify common fluid power symbols, including cylinders, motors, pumps, reservoirs, and directional control valves;

(B) differentiate between schematic and pictorial diagrams;

(C) match fluid power schematic symbols to physical components in a system;

(D) construct and operate a basic fluid power circuit given a schematic with a directional control valve and a double-acting cylinder; and

(E) draw a fluid power schematic from a given fluid power application.

(4) The student demonstrates understanding of the characteristics and applications of fluid power systems. The student is expected to:

(A) analyze pressure gauge readings to identify potential internal and external leakage issues in fluid power systems;

(B) analyze flow meters to detect proper and improper system flow in fluid power systems;

(C) analyze temperature gauges to detect heat issues within fluid power systems;

(D) explain the operational difference between hydraulic and pneumatic systems;

(E) explain the importance of dryers in pneumatic systems, including the prevention of moisture-related issues; and

(F) explain the importance of lubrication in a pneumatic system, including the reduction of friction, prevention of wear and tear, and enhancement of system efficiency.

(5) The student applies mathematical calculations to various operations of a fluid power system. The student is expected to:

(A) describe and analyze pressure, force, and volume in the context of fluid power systems;

(B) calculate output force and rod speed given cylinder size, flow rate, and pressure applied;

(C) describe and calculate how a change in pressure or volume results in change in force;

(D) describe and calculate how change in volume results in change of rod speed and force applied; and

(E) calculate the force output of an extending cylinder using Pascal's Law.

(6) The student understands the function of various components in fluid power systems. The student is expected to:

(A) differentiate between a pneumatic compressor and a hydraulic pump;

(B) describe the functions of a hydraulic reservoir such as fluid storage, fluid cooling, and contaminant separation;

(C) describe the function of various pumps, including piston, gear, and vane pumps;

(D) differentiate between a fixed and variable displacement pump;

(E) explain the purpose of an actuator in fluid power systems;

(F) explain the purpose of various gauges and meters in fluid power systems;

(G) explain the purpose of various pressure controlling devices in hydraulic systems, including pressure relief valves, pressure reducing valves, sequence valves, and counterbalance valves;

(H) explain the purpose of various pressure controlling devices in pneumatic systems, including regulators and pressure relief valves;

(I) explain the purpose of various flow controlling devices in fluid power systems, including check valves, directional control valves, needle valves, and flow controls;

(J) explain the purpose of various motors in fluid power systems, including unidirectional and bi-directional motors;

(K) describe the function of hydraulic and pneumatic actuators, including motor, cylinder, and rotary actuators;

(L) describe the function of various hydraulic and pneumatic cylinders, including single- and double-acting, single- and double-rod, and rodless cylinders;

(M) describe the function of a fluid power double-acting cylinder;

(N) describe and analyze the function of flow control valves in regulating actuator speed in a fluid power circuit;

(O) identify and explain the function of a check valve; and

(P) explain the function of an accumulator.

(7) The student designs basic fluid power circuits using various components in a fluid power system. The student is expected to:

(A) design a fluid power circuit with a unidirectional motor;

(B) design a fluid power circuit with a bi-directional motor;

(C) design a fluid power circuit with multiple cylinders;

(D) design a fluid power circuit with a flow control valve to regulate actuator speed;

(E) design a fluid power circuit incorporating a check valve;

(F) design a basic fluid power circuit incorporating various configurations of directional control valves to alter flow direction;

(G) design fluid power circuits using various operators for directional control, including lever, solenoid, pilot, and push button operator;

(H) design a hydraulic sequence valve to operate multiple actuators in sequence; and

(I) design a hydraulic pressure reducing valve to lower pressure in a branch circuit.

(8) The student installs various components in a fluid power system. The student is expected to:

(A) connect fluid power circuits using various connecting methods, including threaded, push-fit, and quick disconnect fittings;

(B) identify and demonstrate proper safety procedures required for system installation such as lockout/tagout to control hazardous energy;

(C) install a fluid power circuit with a unidirectional motor;

(D) install a fluid power circuit with a bi-directional motor;

(E) install a fluid power circuit with multiple cylinders;

(F) install a fluid power circuit with a flow control valve to regulate actuator speed;

(G) install a fluid power circuit using a check valve;

(H) install a basic fluid power circuit using various configurations of directional control valves to change flow direction;

(I) install fluid power circuits using various operators for the directional control valve, including lever, solenoid, pilot, and push button operator;

(J) install and adjust a pneumatic system regulator to match a defined system pressure setting;

(K) install and adjust a hydraulic power unit relief valve to match a defined system pressure setting;

(L) install a hydraulic sequence valve to operate multiple actuators in sequence; and

(M) install a hydraulic pressure reducing valve to lower pressure in a branch circuit.

(9) The student uses industry standard practices to maintain functional capacity in fluid power systems. The student is expected to:

(A) analyze service data to develop and implement preventive maintenance schedules;

(B) analyze and document repair data to develop and implement predictive maintenance schedules;

(C) inspect components in a fluid power system to identify signs of malfunction, including discoloration, vibration, and loud sounds;

(D) inspect hydraulic fluid to identify contaminants and signs of viscosity breakdown;

(E) explain and demonstrate procedures to change filters in a fluid power system; and

(F) explain and demonstrate procedures to drain and replace hydraulic fluid.

(10) The student understands the function of a basic vacuum system. The student is expected to:

(A) identify and explain the function of a venturi vacuum application;

(B) connect and read a vacuum gauge;

(C) connect and read a manometer;

(D) connect and operate a vacuum generator;

(E) identify and explain the function of a vacuum generator; and

(F) connect a venturi to a pneumatic system.

Source: The provisions of this §127.830 adopted to be effective February 24, 2026, 51 TexReg 1124.

§127.865. Practicum in Manufacturing (Two Credits), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Manufacturing Career Cluster. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) The Practicum in Manufacturing course is designed to give students supervised practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student applies concepts of critical thinking and problem solving. The student is expected to:

(A) analyze elements of a problem;

(B) analyze information critically to determine its value; and

(C) conduct technical research to gather information for decision making.

(2) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:

(A) analyze leadership characteristics such as trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation;

(B) demonstrate teamwork skills through working cooperatively with others to achieve tasks;

(C) demonstrate teamwork processes such as promoting team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution;

(D) demonstrate responsibility for organization tasks such as shared group and individual work tasks; and

(E) establish and maintain effective working relationships.

(3) The student demonstrates oral and written communication skills. The student is expected to:

(A) demonstrate the use of content such as technical concepts and vocabulary;

(B) employ verbal skills when obtaining and conveying information;

(C) use informational texts such as Internet websites and technical materials for occupational tasks;

(D) evaluate the reliability of information such as Internet websites, technical materials, and resources;

(E) interpret verbal and nonverbal cues and behaviors to enhance communication;

(F) apply active listening skills such as obtaining and clarifying the information; and

(G) use academic skills such as effective written and oral communication.

(4) The student demonstrates technical knowledge and skills required to pursue a career in the manufacturing cluster. The student is expected to:

(A) use information literacy skills such as accessing, evaluating, and disseminating information;

(B) describe information management;

(C) maintain records to facilitate ongoing business operations;

(D) develop goals;

(E) prioritize tasks;

(F) develop timelines using time-management skills;

(G) use project-management skills such as initiate, plan, execute, monitor and control, and close to improve workflow;

(H) evaluate proficiencies in technical skills; and

(I) accept critical feedback provided by the supervisor.

(5) The student documents technical knowledge and skills using a professional portfolio. The student is expected to:

(A) demonstrate growth of technical skill competencies;

(B) demonstrate technical knowledge and skills by completing activities such as earning licensures or certifications;

(C) develop an abstract of key points of the practicum;

(D) create a job-skills resume;

(E) collect representative work samples;

(F) maintain copies of evaluations from the practicum supervisor and/or industrial representative; and

(G) present the portfolio to interested stakeholders.

Source: The provisions of this §127.865 adopted to be effective August 1, 2025, 50 TexReg 4421.

§127.866. Extended Practicum in Manufacturing (One Credit), Adopted 2015.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2017-2018 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical

education courses in the Manufacturing Career Cluster. Corequisite: Practicum in Manufacturing. This course must be taken concurrently with Practicum in Manufacturing and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(c) Introduction.

(1) Career and technical education 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) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) The Extended Practicum in Manufacturing course is designed to give students supervised practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student implements advanced professional communications strategies. The student is expected to:

(A) demonstrate verbal and non-verbal communication consistently in a clear, concise, and effective manner;

(B) analyze, interpret, and effectively communicate information, data, and observations;

(C) observe and interpret verbal and nonverbal cues and behaviors to enhance communication; and

(D) apply active listening skills to obtain and clarify information.

(2) The student applies concepts of critical thinking and problem solving. The student is expected to:

(A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions;

(B) analyze elements of a problem to develop creative and innovative solutions; and

(C) conduct technical research to gather information necessary for decision making.

(3) The student understands and applies proper safety techniques in the workplace. The student is expected to:

(A) demonstrate an understanding of and consistently follow workplace safety rules and regulations; and

(B) demonstrate knowledge of procedures for reporting and handling accidents and safety incidents.

(4) The student understands the professional, ethical, and legal responsibilities in teaching and training. The student is expected to:

(A) demonstrate a positive, productive work ethic by performing assigned tasks as directed;

(B) apply ethical reasoning to a variety of situations in order to make ethical decisions; and

(C) comply with all applicable rules, laws, and regulations in a consistent manner.

(5) The student participates in a manufacturing experience. The student is expected to:

(A) conduct, document, and evaluate learning activities in a supervised manufacturing experience;

(B) develop advanced technical knowledge and skills related to the student's occupational objective;

(C) demonstrate growth of technical skill competencies;

(D) evaluate strengths and weaknesses in technical skill proficiency; and

(E) collect representative work samples.

Source: The provisions of this §127.866 adopted to be effective August 1, 2025, 50 TexReg 4421.