



Spokane Public Schools Pre-Engineering/Manufacturing Processes (Metals)

Course: Pre-Engineering/Manufacturing Processes (Metals)		Total Framework Hours up to: 540 Hours
CIP Code: 140102	<input checked="" type="checkbox"/> Exploratory <input type="checkbox"/> Preparatory	Date Last Modified: 4/24/2015
Career Cluster: STEM		Cluster Pathway: Engineering and Technology

COMPONENTS AND ASSESSMENTS

Performance Assessments:

- Model safe practices and meet all safety requirements to work in the lab environment
- Participate in teams to continuously improve safety in the learning environment
- Work as a team member to maintain a safe and efficient classroom and identify focus for continuous improvement projects (5S Audits)
- Participate in continuous improvement project planning and execution including present and future state documentation (kaizen projects) (TL)
- Locate, interpret, and apply MSDS information, when asked by instructor, e.g., a site evaluation/inspection as occurs in industry

Leadership Alignment:

- Be Flexible
- Work Effectively in Diverse Teams
- Be Responsible to Others

Classroom Focus:

- Modify procedures to accommodate safety and production constraints
- Implement safety and teamwork while improving performance in the lab
- Manage and share information to maintain and improve efficiency and safety practices

Standards and Competencies

Standard/Unit: C-1 Safety and Teamwork

Competencies

Total Learning Hours for Unit: 60 Hours

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| C-1.1 TL | Understand importance of working in a team environment |
| C-1.2 TL | Understand etiquette of working in a team environment |
| C-1.3 | Understand business and personal ethics |
| C-1.4 | Understand responsibilities of employee to employer and vice-versa |
| C-1.5 TL | Aware of indicators and methods to prevent discrimination, harassment, and promote equality in the work environment |
| C-1.6 TL | Understand methods and concepts of problem solving |
| A-1.7 TL | Demonstrate team and leadership skills |
| C-1.8 | Understand the structure of typical manufacturing organizations. |
| C-1.9 TL | Understand interactions, advantages, and promote a diverse work force |
| C-1.10 TL | Discuss importance of organizational integration in manufacturing a product |
| C-1.11 | Understand responsibilities of line and staff organizations |
| C-1.12 | Understand electronic communications in linking manufacturing processes |

A-1.13 TL	Able to facilitate group meetings
C-1.14	Follow all established safety practices in the lab
C-1.15 TL	Understand and apply 5S concepts to maintain a safe, efficient learning environment
C-1.16	Know and apply safe practices with hand tools
C-1.17	Know and apply safe practices with power tools
C-1.18 TL	Knows 5S and applies sustaining practices
C-1.19 TL	Recognizes and uses visual systems
A-1.20 TL	Applies 5S audits and documents progress
A-1.21 TL	Proficient in root cause analysis and 5-why's.
A-1.22 TL	Leads and designs projects to improve and develop visual management tools
C-1.23	Demonstrates understanding and applies proper use of PPE
C-1.24	Know the location and application of MSDS records
A-1.25 TL	Audit MSDS sheets and know how to locate and update MSDS documents
A-1.26 TL	Design and implement error/injury prevention (poke yoke) strategies

Aligned Washington State Standards

Arts		
Educational Technology	EALR 1.1.1	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology
	EALR 1.1.2	Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others
	EALR 1.1.3	Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools and resources
	EALR 2.2.1	Practice Safety: Practice safe, legal, and ethical behavior in the use of information and technology
	EALR 2.2.2	Operate Systems: Understand technology systems and use hardware and networks to support learning
	EALR 2.2.3	Select and Use Applications: Use productivity tools and common applications effectively and constructively
	EALR 2.2.4	Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies
Health and Fitness		
Language		
Math	HSA-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
	MP.2	Reason abstractly and quantitatively.
	MP.4	Model with mathematics.
Reading	RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
	RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
	WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
Science	HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering
	HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts
	HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem
	HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and

	HS-ESS3-4	biodiversity Evaluate or refine a technological solution that reduces impacts of human activities on natural systems
Social Studies		
Speaking and Listening	SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Writing	WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
	WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
	WSHT.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Accurately apply math concepts and skills as a tool to make decisions regarding work with material and manufacturing processes

Leadership Alignment:

- Reason Effectively
- Make Judgments and Decisions
- Solve Problems

Classroom Focus:

- Use measurement and mathematical process to gain information and make decisions
- Use measurement and mathematical process to gain information and make decisions
- Use math as a tool to solve measurement and fabrication problems in the field

Standards and Competencies

Standard/Unit: C-2 Introduction to Manufacturing Math

Competencies

Total Learning Hours for Unit: 30 Hours

- C-2.1 Add, subtract, multiply, and divide whole numbers, with and without a calculator
- C-2.2 Use a standard ruler and metric ruler to measure.
- C-2.3 Add, subtract, multiply, and divide fractions.
- C-2.4 Convert decimals to percentages and percentages to decimals.
- C-2.5 Recognize and use metric units of length, weight, volume, and temperature.
- C-2.6 Recognize some of the basic shapes used in the manufacturing industry, and apply basic geometry to measure them
- C-2.7 Convert denominate numbers and solve problems using them
- C-2.8 Calculate using rules
- C-2.9 Calculate using metric, linear, square, volume, and weight measurements
- C-2.11 Construct simple geometric figures.
- C-2.12 Apply mathematical formulas to solve problems
- C-2.13 Solve problems sequentially with simple equations
- C-2.14 Solve linear, area, volume, and angle measurement problems
- C-2.15 Solve percentage problems
- C-2.16 Define and solve ratio and proportion problems
- C-2.17 Use a protractor, a vernier caliper, and a micrometer

- C-2.18 Calculate selected seam allowances
- C-2.19 Demonstrate competence in solving selected field measuring problems
- C-2.20 Apply standard rules and practice for solving selected field measurement problems
- C-2.22 Demonstrate competence in solving selected field measuring problems
- C-2.23 Apply standard rules and practices for solving selected field measurement problems
- A-2.24 Apply math and technology tools and strategies to determine surface areas and volumes of 3-dimensional products
- A-2.25 Apply math and technology tools and strategies to analyze strength to weight considerations in product design
- A-2.26 Collect and implement graphs and equations to contrasts variable processes

Aligned Washington State Standards

Arts	
Educational Technology	EALR 1.1.3 Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools and resources
Health and Fitness	
Language	
Math	<p>HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.</p> <p>HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p> <p>HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p>
Reading	<p>RST 9-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.</p> <p>RST 9-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.</p> <p>RST 9-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p>
Science	
Social Studies	
Speaking and Listening	SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Writing	<p>WHST.9-12.8 Analyzes ideas, selects a manageable topic, and elaborates using specific, relevant details and/or examples.</p> <p>WHST 9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p>

COMPONENTS AND ASSESSMENTS

<p>Performance Assessments: Accurately use tools for measurement to produce products within acceptable tolerances</p>
<p>Leadership Alignment: Reason Effectively Make Judgments and Decisions</p>

Solve Problems Apply Technology Effectively Classroom Focus: <ul style="list-style-type: none"> • Use measurement and mathematical process to gain information and make decisions • Use measurement and mathematical process to gain information and make decisions • Use math as a tool to solve measurement and fabrication problems in the field • Apply Technology Calibrate and use measurement tool to obtain information

Standards and Competencies

Standard/Unit: C-3 Measurement

Competencies	Total Learning Hours for Unit: 30 Hours
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- C-3.1 Describe measurement's role in manufacturing and production
- C-3.2 Identify types of measurement used in manufacturing and production
- C-3.3 Understand the importance of calibrating instruments
- C-3.4 Select proper tools for measurement
- C-3.5 Convert units from one measurement system to another
- C-3.6 Lists characteristics of measurement tools
- C-3.7 Perform measurements with general and precision tools
- C-3.8 Describe common measuring errors and proper techniques
- C-3.9 Describe measuring systems

Aligned Washington State Standards

Arts	
Educational Technology	EALR 1.1.3 Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools and resources
Health and Fitness	
Language	
Math	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Reading	RST.9-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
Science	
Social Studies	
Speaking and Listening	SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Writing	WHST.9-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Develop and use tools for error proofing

Design, apply, and improve production systems that embed quality assurance checks and maintenance

Assess production systems for quality assurance and improvement

Leadership Alignment:

Think Creatively

Work Creatively with Others

Implement Innovations

Reason Effectively

Use Systems Thinking

Make Judgments and Decisions

Solve Problems

Communicate Clearly

Collaborate with Others

Access and Evaluate Information

Use and Manage Information

Adapt to Change

Be Flexible

Manage Goals and Time

Interact Effectively with Others

Work Effectively in Diverse Teams

Manage Projects

Produce Results

Guide and Lead Others

Be Responsible to Others

Classroom Focus:

- Work in groups to list pros and cons of real world application
- 5S Project

Community Focus:

- Compile a list of pros and cons
- Class Improvement Project

Standard/Unit: C-4 Quality Assurance and Process Economics

Competencies

Total Learning Hours for Unit: 60 Hours

C-4.1	Define quality in manufacturing
A-4.2	Understand how quality can improve profit
C-4.3	Apply principles of continuous quality improvement
A-4.4 TL	Understand and apply statistical process control
A-4.5 TL	Evaluate data to monitor production processes
A-4.6 TL	Analyze consumer problems caused by manufacturing and recommend solutions
A-4.7 TL	Establish plans and procedures to maintain quality
C-4.8	Define profit and loss and explain why profit is important
A-4.9	Discuss impact of customer satisfaction on overhead and reputation

C-4.10	Understand real and hidden costs of an accident
C-4.11 TL	Define value added
A-4.12 TL	Understand impact of learning curve on costing and pricing
A-4.13	Name factors to be considered in make or buy decisions
A-4.14	List employee benefits commonly provided by industry
A-4.15	Demonstrate knowledge of computer software applications in manufacturing
A-4.16 TL	Understand how production rates are determined (takt time)
A-4.17 TL	Understand inventory control, material forecasting, and capacity planning
C-4.18	Knowledge of work processing, spreadsheets, databases, statistical, and graphical software
A-4.19	Understand and apply budgeting and master scheduling techniques
A-4.20	Define product and process control and explain the importance of each
A-4.21 TL	Apply statistical techniques to monitor and improve processes
C-4.22 TL	Explain just in time inventory
C-4.23	Explain factors that affect work in progress
A-4.24 TL	Design a flow diagram for producing a product
C-4.25	Define roles of designers and engineers in developing a product
A-4.26 TL	Explain the importance of configuration control
A-4.27	List major factors in process planning
C-4.28	Understand design for manufacturing
A-4.29 TL	Design and implement identification and error proofing strategies (poka yoke) in manufacturing processes

Aligned Washington State Standards

Arts		
Educational Technology	EALR 1.1.1	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology
	EALR 1.1.2	Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others
	EALR 1.1.3	Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools and resources
	EALR 2.2.1	Practice Safety: Practice safe, legal, and ethical behavior in the use of information and technology
	EALR 2.2.2	Operate Systems: Understand technology systems and use hardware and networks to support learning
	EALR 2.2.3	Select and Use Applications: Use productivity tools and common applications effectively and constructively
	EALR 2.2.4	Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies
Health and Fitness		
Language		
Math	MP.2	Reason abstractly and quantitatively.
	MP.4	Model with mathematics.
	HSA-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
Reading	RST.9-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
	RST 9-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
	RST 9-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
Science	HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.

	HSN-Q.A.3 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Social Studies		
Speaking and Listening	SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Writing	WHST.9-12.8 WHST 9-12.1 WHST 9-12.7	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. Write arguments focused on discipline-specific content. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Create precise annotated detail in design for accurate production

Accurately read and apply print plans the production process

Given a set of plans, the students will list and define all symbols and annotations. Students will use the appropriate tools/technology necessary to complete the assessment task.

Produce drawings and/or sketches to required appropriate standards as determined by research, mathematical calculations, and/or other design criteria.

Leadership Alignment:

Think Creatively

Work Creatively with Others

Implement Innovations

Reason Effectively

Make Judgments and Decisions

Solve Problems

Communicate Clearly

Collaborate with Others

Access and Evaluate Information

Use and Manage Information

Apply Technology Effectively

Adapt to Change

Work Independently

Be Self-Directed Learners

Interact Effectively with Others

Work Effectively in Diverse Teams

Classroom Focus:

- Brainstorm new and creative ideas

- Work in groups to list pros and cons of real world application
- Create action plan to implement new concepts and products
- Test production and innovation
- Create documentation to share with industry partners
- Discuss how to define valid data

Community Focus:

- Draw and sketch key concepts
- Compile a list of pros and cons
- Research current trends in industry
- Analyze and trouble shoot test results
- Meet with industry partners and share ideas
- Oral presentation in groups to community members and/or industry partners
- Research valid and current technical data
- Create a flow chart based on data

Standards and Competencies

Standard/Unit: C-5 Design/Plan Interpretation

Competencies

Total Learning Hours for Unit: 60 Hours

- C-5.1 Interpret notes and dimensions to determine sizes, materials, and other requirements
- C-5.2 Identify and explain basis items in detailed drawings
- C-5.3 Identify basic types of drawing and list the purposes of each
- C-5.4 Interpret drawing elements regarding layout, plan, production, and inspection
- C-5.5 Read technical drawings and documents to plan a project.
- C-5.6 Create freehand technical sketches
- C-5.7 Produce appropriate orthographic, auxiliary and section drawings and/or sketches to standards determined by research, mathematical calculations, and/or other design criteria.
- C-5.8 Identify and create axonometric drawings
- C-5.9 Identify and create oblique drawings
- C-5.10 Identify and create perspective drawings

Aligned Washington State Standards

Arts	
Educational Technology	EALR 1.1.2 Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others
	EALR 1.1.3 Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools and resources
	EALR 2.2.2 Operate Systems: Understand technology systems and use hardware and networks to support learning
	EALR 2.2.3 Select and Use Applications: Use productivity tools and common applications effectively and constructively
	EALR 2.2.4 Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies
Health and Fitness	
Language	
Math	MP.2 Reason abstractly and quantitatively.
	MP.4 Model with mathematics.
Reading	RST.9-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

	RST 9-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
	RST 9-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
	RST 9-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Science		
Social Studies		
Speaking and Listening	SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Writing	WHST.9-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Rate, select, and use proper weld techniques to produce quality beads.

Properly prepare base metal to produce good weld quality.

Plan and fabricate products using flat stock.

Plan and fabricate products using round stock.

Leadership Alignment:

Collaborate with Others

Solve Problems

Use and Manage Information

Adapt to Change

Manage Goals and Time

Work Independently

Be Self-Directed Learners

Interact Effectively with Others

Work Effectively in Diverse Teams

Manage Projects

Produce Results

Guide and Lead Others

Classroom Focus:

- Test production and innovation
- Discuss how to define valid data
- 5S Lesson

Community Focus:

- Analyze and trouble shoot test results
- Oral presentation in groups to community members and/or industry partners
- Create a flow chart based on data
- Class improvement project

Standards and Competencies

Standard/Unit: C-6 Build/Fabrication: Shop Skills and Material Processes: Metal**Competencies****Total Learning Hours for Unit: 240 Hours**

C-6.1	Show working knowledge of fundamental shop skills
C-6.2	Understand how tools and fixtures are used in manufacturing
C-6.3	Demonstrate use of common machine tools
C-6.4	Demonstrate basic skills of fabricating, assembling, and testing a product
C-6.5	Select appropriate tools for layouts and inspection
C-6.6	Demonstrate basic electrical wiring skills
C-6.7	Identify and use tools and procedures to form, cut, finish, fasten, and repair
C-6.8	Behaviors and characteristics of manufacturing materials
C-W-1	Properly prepare base metal to produce good weld quality
C-W-2	Identify, rate, select, and use proper weld techniques to produce quality beads
C-W-3	Produce quality fillet welds and advanced metal cutting processes
A-W-1	Interpret welding symbols and use joint fit-up tools to produce quality fillet welds.
A-W-2	Master intermediate shielded metal arc welding techniques used in 1G, 3G, 4G, 5G, and 6G positions on groove welds with backing and open V-butt welds.
A-w-3	Master intermediate shielded metal arc welding techniques used in 1G, 3G, 4G, 5G, and 6G positions in open-root pipe welds
A-w-4	Develop skills in reading welding detail drawings and air carbon cutting arc and gouging
A-W-5	Set-up GTAW and FCAW equipment and use filler metals to weld plate in the 1G, 3G, 5G, and 6G positions.
A-W-6	Develop skills in Gas Metal Arc Welding (GMAW) of pipe and aluminum plate and pipe in the 1G, 3G, 5G, and 6G positions.
A-W-7	Develop skills in Gas Tungsten Arc Welding (GTAW) of stainless pipe and aluminum plate and pipe in the 1G, 3G, 5G, and 6G positions.
A-W-8	Develop skills in Shielded Metal Arc Welding (SMAW) of stainless steel groove welds and Gas Tungsten Arc Welding (GTAW) of stainless steel pipe.
C-SM-1.1	Describe what is meant by pride of craftsmanship in the sheet metal trade
C-SM-1.2	Name the general applications of sheet metal construction
C-SM-1.3	List the basic tools and equipment used in the sheet metal trade
C-SM-1.4	Summarize the history and development of the sheet metal trade
C-SM-1.5	Describe what is involved in being part of a sheet metal training program
C-SM-2.1	Describe how to use a sheet metal gauge
C-SM-2.1	Identify and describe the proper use of tools commonly used in the sheet metal trade
C-SM-2.3	State general rules for safety when using tools
C-SM-2.4	Describe proper maintenance procedures for tools
C-SM-2.5	Demonstrate how to properly use sheet metal tools
C-SM-3.1	Define basic trade terms pertaining to sheet metal layout
C-SM-3.2	Demonstrate skill and competence in the selection and use of layout and marking tools
C-SM-3.3	Identify and explain the three development methods for laying out sheet metal patterns
C-SM-4.1	Demonstrate skill in the selection and use of hand snips, hacksaws, and squaring shears for cutting out sheet metal parts and patterns
C-SM-4.2	Demonstrate the ability to select and use forming tools
C-SM-4.3	Demonstrate skill and competence in the construction of seams and edges.
C-SM-5.1	Describe the factors that influence bend allowances on sheet metal blanks
C-SM-5.2	Perform the calculations necessary for determining proper bend allowances on selected sheet metal problems
C-SM-5.3	Demonstrate how to lay out and fabricate according to calculations
A-SM-5.4	Determine bend allowances on selected sheet metal problems
C-BS-6-1	Demonstrate the ability to set up and used manual power tools (mills, lathes, benders, saws)
C-BS-6.2	Properly account for stretch in bar stock forming

C-BS-6.3	Demonstrate the ability to pre-treat and condition bar stock for forming
C-BS-6.4	Post-treat bar stock for hardening

Aligned Washington State Standards

Arts	HSN-Q.A.2 HSN-Q.A.3	Define appropriate quantities for the purpose of descriptive modeling. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Educational Technology	EALR 1.1.1 EALR 2.2.1 EALR 2.2.3 EALR 2.2.4	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology Practice Safety: Practice safe, legal, and ethical behavior in the use of information and technology Select and Use Applications: Use productivity tools and common applications effectively and constructively Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies
Health and Fitness		
Language		
Math		
Reading		
Science	HS-PS1-1 HS-PS1-3 HS-PS1-8 HS-PS2-6	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials
Social Studies		
Speaking and Listening		
Writing		

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Assess automation as a tool to accomplish manufacturing tasks
Robotics: Design, build, and program robots to accomplish assigned tasks

Leadership Alignment:
Communicate Clearly
Collaborate with Others
Community Focus:

- Oral presentation in groups to community members and/or industry partners

Standards and Competencies

Standard/Unit: C-7 Automation in Manufacturing

Competencies	Total Learning Hours for Unit: 30 Hours
C-7.1 Consider when automation can be used	
C-7.2 Automated manufacturing systems	
C-7.3 Sensors and devices used in automated manufacturing systems	

Aligned Washington State Standards

Arts		
Educational Technology	EALR 1.1.1	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology
	EALR 1.1.3	Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools and resources
	EALR 2.2.1	Practice Safety: Practice safe, legal, and ethical behavior in the use of information and technology
	EALR 2.2.2	Operate Systems: Understand technology systems and use hardware and networks to support learning
	EALR 2.2.3	Select and Use Applications: Use productivity tools and common applications effectively and constructively
	EALR 2.2.4	Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies
Health and Fitness		
Language		
Math	MP.2	Analyze a problem situation to determine the question(s) to be answered
	MP.4	Identify relevant, missing, and extraneous information related to the solution to a problem.
	HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
	HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
	HSN-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Reading	RST.9-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
	RST 9-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
	RST 9-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Science	HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
Social Studies		
Speaking and Listening	SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Writing	WHST.9-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
	WHST 9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.

COMPONENTS AND ASSESSMENTS

Performance Assessments:
 Career and college ready portfolio
 Continuous improvement projects

Leadership Alignment:
 Think Creatively
 Work Creatively with Others
 Implement Innovations
 Reason Effectively
 Use Systems Thinking
 Make Judgments and Decisions
 Solve Problems

Communicate Clearly
 Collaborate with Others
 Access and Evaluate Information
 Use and Manage Information
 Analyze Media
 Create Media Products
 Apply Technology Effectively
 Adapt to Change
 Be Flexible
 Work Independently
 Be Self-Directed Learners
 Interact Effectively with Others
 Work Effectively in Diverse Teams
 Manage Projects
 Produce Results
 Guide and Lead Others
 Be Responsible to Others

Classroom Focus:

- Define media literacy
- Understand media tools

Community Focus:

- Create a media document

Standards and Competencies

Standard/Unit: C-8 Career and College Readiness

Competencies

Total Learning Hours for Unit: 30 Hours

C-8.1	Investigate potential careers based on career interest surveys, industry experiences, personal hobbies, and/or geographic and cultural interests
C-8.2	Develop and manage a program of study for postsecondary planning
C-8.3	Record a profile of classes specific to career interests and preparation
C-8.4 TL	Participate in seminars for industry specific training and experiences
C-8.5	Tour industry sites and record experiences in a personal profile
C-8.6	Develop a resume of experiences that are related to career and postsecondary interests
A-8.7	Collect letters of recommendation for areas of postsecondary interest
A-8.8 TL	Collect data to document implementation of a continuous improvement project in a classroom environment
A-8.9 TL	Write a descriptions of the present and future states of a CI targets
A-8.10 TL	Organize a team s and develop a plans to implement CI projects
A-8.11 TL	Implement project management tools and strategies for a CI projects
C-9.12	Develop and maintain records illustrating project progress indicating before and after implementation
C-8.13	Collect data and develop a narrative description assessing the results of continuous improvement projects

Aligned Washington State Standards

Arts	
Educational Technology	EALR 1.1.1 Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology
	EALR 1.1.3 Investigate and Think critically: Research, manage, and evaluate information and solve problems using digital tools

	EALR 2.2.1 EALR 2.2.2 EALR 2.2.4	and resources Practice Safety: Practice safe, legal, and ethical behavior in the use of information and technology Operate Systems: Understand technology systems and use hardware and networks to support learning Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies
Health and Fitness		
Language		
Math	MP.2 MP.4	Reason abstractly and quantitatively. Model with mathematics.
Reading	RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
Science		
Social Studies		
Speaking and Listening		
Writing	WHST.9-12.8 WHST 9-12.9	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. Draw evidence from informational texts to support analysis, reflection, and research.

21st Century Skills

Check those that students will demonstrate in this course:

<p>LEARNING & INNOVATION</p> <p>Creativity and Innovation <input checked="" type="checkbox"/> Think Creatively <input checked="" type="checkbox"/> Work Creatively with Others <input checked="" type="checkbox"/> Implement Innovations</p> <p>Critical Thinking and Problem Solving Reason Effectively <input checked="" type="checkbox"/> Use Systems Thinking <input checked="" type="checkbox"/> Make Judgments and Decisions <input checked="" type="checkbox"/> Solve Problems</p> <p>Communication and Collaboration <input checked="" type="checkbox"/> Communicate Clearly <input checked="" type="checkbox"/> Collaborate with Others</p>	<p>INFORMATION, MEDIA & TECHNOLOGY SKILLS</p> <p>Information Literacy <input checked="" type="checkbox"/> Access and /evaluate Information <input checked="" type="checkbox"/> Use and Manage Information</p> <p>Media Literacy <input checked="" type="checkbox"/> Analyze Media <input checked="" type="checkbox"/> Create Media Products</p> <p>Information, Communications and Technology (ICT Literacy) <input checked="" type="checkbox"/> Apply Technology Effectively</p>	<p>LIFE & CAREER SKILLS</p> <p>Flexibility and Adaptability <input checked="" type="checkbox"/> Adapt to Change <input checked="" type="checkbox"/> Be Flexible</p> <p>Initiative and Self-Direction <input checked="" type="checkbox"/> Manage Goals and Time <input checked="" type="checkbox"/> Work Independently <input checked="" type="checkbox"/> Be Self-Directed Learners</p> <p>Social and Cross-Cultural <input checked="" type="checkbox"/> Interact Effectively with Others <input checked="" type="checkbox"/> Work Effectively in Diverse Teams</p> <p>Productivity and Accountability <input checked="" type="checkbox"/> Manage Projects <input checked="" type="checkbox"/> Produce Results</p> <p>Leadership and Responsibility <input checked="" type="checkbox"/> Guide and Lead Others <input checked="" type="checkbox"/> Be Responsible to Others</p>
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