



**Connecticut Technical Education and Career System**

# **Welding and Metal Fabrication**

## **Curriculum Guide**

**Rev. January 2026**

# Table of Contents

## Contents

CTECS - Vision of Graduate .....	4
CTECS Instructional Model.....	7
Curriculum Introduction .....	8
Curriculum Components .....	8
Welding & Metal Fabrication Philosophy.....	0
Welding and Metal Fabrication – Course Map .....	1
9th Grade Curriculum .....	3
Priority Standard 9.1 - Shop Safety .....	3
Priority Standard 9.2 - Career Readiness.....	5
Priority Standard 9.3 - Hand Tools .....	6
Priority Standard 9.4 - Introduction to Abrasive Equipment.....	7
Priority Standard 9.5 - Shielded Metal Arc Welding (SMAW).....	9
Priority Standard 9.6 - Gas Metal Arc Welding (GMAW) .....	11
Priority Standard 9.7 - Introduction to Plasma Arc Cutting (PAC).....	13
Priority Standard 9.8 - Introduction to Oxy-Fuel Cutting.....	14
Priority Standard 9.9 - Introduction to Basic Welding Math.....	16
Priority Standard 9.10 - Welding Projects .....	18
10th Grade Curriculum .....	20
Priority Standard 10.1 - Shop and Site Safety (OSHA 10) .....	20
Priority Standard 10.2 - Shielded Metal Arc Welding (SMAW).....	22
Priority Standard 10.3 - Blueprint Reading.....	24
Priority Standard 10.4 - Plasma Arc Cutting (Advanced) .....	25
Priority Standard 10.5 - Gas Metal Arc Welding (GMAW) .....	26
Priority Standard 10.6 - Oxy-Fuel Cutting (Advanced) .....	27
Priority Standard 10.7 - Basic Welding Electricity.....	28
Priority Standard 10.8 - Welding Math Advanced .....	29
Priority Standard 10.9 - Introduction to Welding Procedure Specification.....	30
Priority Standard 10.10 - Welding Projects .....	31
11th Grade Curriculum .....	33
Priority Standard 11.1 - Shop and Jobsite Safety.....	33
Priority Standard 11.2 - Shielded Metal Arc Welding (SMAW) Advanced .....	36
Priority Standard 11.3 - Measurement and Fabrication .....	38

Priority Standard 11.4 - Gas Metal Arc Welding (GMAW) Advanced.....	40
Priority Standard 11.5 - Advanced Welding Procedures.....	41
Priority Standard 11.6 - Introduction Gas Tungsten Arc Welding (GTAW) .....	42
Priority Standard 11.7 - Introduction to Pipe and Tube Welding.....	44
Priority Standard 11.8 - Introduction to Flux Cored Arc Welding (FCAW) .....	46
Priority Standard 11.9 - Intro to Weld Inspection.....	48
Priority Standard 11.10 - Welding Project/Production.....	50
12th Grade Curriculum .....	52
Priority Standard 12.1 - Shop and Job Site Safety .....	52
Priority Standard 12.2 - Welding Tools and Equipment .....	54
Priority Standard 12.3 - Blueprint Reading and Welding Math.....	56
Priority Standard 12.4 - Shielded Metal Arc Welding (SMAW) Advance .....	58
Priority Standard 12.5 - Gas Metal Arc Welding (GMAW) Advanced.....	60
Priority Standard 12.6 - Gas Tungsten Arc Welding (GTAW) Advanced.....	62
Priority Standard 12.7 - Cutting (PAC & OFC) Advanced Procedures .....	64
Priority Standard 12.8 - Pipe and Tube Welding Advanced.....	66
Priority Standard 12.9 - Welder Certification Gas Metal Arc Welding .....	68
Priority Standard 12.10 - Introduction to Gas Metal Arc Welding Spray.....	71
Priority Standard 12.11 - Welding Project/Production.....	73

## CTECS - Vision of Graduate

Connecticut Technical Education and Career System

# Vision of a Graduate

*A CTECS Graduate is...*



**A Problem Solver**



**Work Ready**



**Respectful**



**Skilled Socially**



**A Critical Thinker**



**An Effective Communicator**

**The Vision of a Graduate (VoG)** at the Connecticut Technical Education and Career System (CTECS) embodies our commitment to preparing students for success in Connecticut's workforce.

Developed in collaboration with students, parents, staff, and employers, the VoG ensures that CTECS students are not only job-ready but also equipped to lead, innovate, and adapt in a dynamic world.

As educators, we are dedicated to developing these qualities by providing a comprehensive education that empowers our students to achieve their fullest potential and make meaningful contributions to

society.

## A Problem Solver

*Problem solvers tackle challenges by identifying root causes of issues, brainstorming solutions, implementing effective strategies, and demonstrating adaptability.*

- Engage students with open-ended, creative thinking tasks that require both conventional and innovative solutions.
- Facilitate group discussions and collaborative projects.
- Use real-world scenarios and hands-on activities.
- Highlight the importance of effort, persistence, and continuous learning.
- Provide regular feedback and encourage reflection.

## Work Ready

*To be work-ready includes a combination of technical expertise, soft skills, and personal qualities that ensure a graduate can effectively contribute to the workplace from day one.*

- Set high standards for punctuality, responsibility, professionalism, and task completion.
- Use project-based learning and collaborative assignments.
- Emphasize clear written and verbal communication.
- Offer practical exercises like mock interviews and resume workshops.
- Integrate technology and teach digital literacy.

## Respectful

*Graduates who embody respectfulness emphasize the importance of treating others with dignity, valuing diversity, and fostering an inclusive and positive environment, both personally and professionally.*

- Demonstrate personal, interpersonal, and professional skills.
- Show respect for diversity.
- Model respect through active listening and empathy.
- Set clear expectations for respectful interactions.
- Promote collaboration and group discussions.
- Celebrate respectful behavior.
- Address disrespect promptly and constructively.

## Skilled Socially

*Graduates who are skilled socially are equipped to navigate social environments, build relationships, and contribute positively to their communities and workplaces.*

- Show awareness of global responsibility to others and the environment.
- Participate in community involvement.
- Design cooperative group projects and team activities
- Set expectations for respect and give regular feedback.
- Facilitate discussions on inclusivity, kindness, and respect.
- Model positive interactions and recognize strong social skills.

## A Critical Thinker

*Critical thinkers approach problems systematically by analyzing, evaluating, and synthesizing information to make well-informed decisions and contribute to innovative solutions.*

- Encourage critical thinking individually and collaboratively.
- Design lessons that challenge assumptions and explore diverse viewpoints.
- Use open-ended questions, rigorous activities, and cross-curricular projects.
- Integrate project-based learning and real-world problem-solving.
- Offer reflective opportunities like journaling and discussions.
- Cultivate an environment that values curiosity and inquiry.

## An Effective Communicator

*Effective communicators convey ideas, information, and emotions accurately and persuasively, fostering understanding and collaboration.*

- Communicate effectively using oral, written, visual, artistic, and technical modes.
- Include group discussions, presentations, and peer reviews.
- Promote active listening and thoughtful responses.
- Offer clear guidelines and constructive feedback.
- Stress clear, respectful, and purposeful communication.

## CTECS Instructional Model

CTECS uses the Marzano Compendium to guide research-based instructional strategies that differentiate learning and promote access, engagement, and success for all students. Teachers apply these strategies to support diverse learners (including multilingual learners, students with disabilities, and students with varied academic or technical backgrounds) through scaffolds, modeling, guided practice, and multiple ways to participate and show understanding. This approach ensures every student can work toward proficiency in the Priority Standards and the competencies outlined in the CTECS Vision of a Graduate.

Feedback	Content	Context
<p><b>Providing and Communicating Clear Learning Goals</b></p> <ol style="list-style-type: none"> <li>1. Providing scales and rubrics</li> <li>2. Tracking student progress</li> <li>3. Celebrating success</li> </ol> <p><b>Using Assessments</b></p> <ol style="list-style-type: none"> <li>4. Using informal assessments of the whole class</li> <li>5. Using formal assessments of individual students</li> </ol>	<p><b>Conducting Direct Instruction Lessons</b></p> <ol style="list-style-type: none"> <li>6. Chunking content</li> <li>7. Processing content</li> <li>8. Recording and representing content</li> </ol> <p><b>Conducting Practicing and Deepening Lessons</b></p> <ol style="list-style-type: none"> <li>9. Using structured practice sessions</li> <li>10. Examining similarities and differences</li> <li>11. Examining errors in reasoning</li> </ol> <p><b>Conducting Knowledge Application Lessons</b></p> <ol style="list-style-type: none"> <li>12. Engaging students in cognitively complex tasks</li> <li>13. Providing resources and guidance</li> <li>14. Generating and defending claims</li> </ol> <p><b>Using Strategies That Appear in All Types of Lessons</b></p> <ol style="list-style-type: none"> <li>15. Previewing strategies</li> <li>16. Highlighting critical information</li> <li>17. Reviewing content</li> <li>18. Revising knowledge</li> <li>19. Reflecting on learning</li> <li>20. Assigning purposeful homework</li> <li>21. Elaborating on information</li> <li>22. Organizing students to interact</li> </ol>	<p><b>Using Engagement Strategies</b></p> <ol style="list-style-type: none"> <li>23. Noticing and reacting when students are not engaged</li> <li>24. Increasing response rates</li> <li>25. Using physical movement</li> <li>26. Maintaining a lively pace</li> <li>27. Demonstrating intensity and enthusiasm</li> <li>28. Presenting unusual information</li> <li>29. Using friendly controversy</li> <li>30. Using academic games</li> <li>31. Providing opportunities for students to talk about themselves</li> <li>32. Motivating and inspiring students</li> </ol> <p><b>Implementing Rules and Procedures</b></p> <ol style="list-style-type: none"> <li>33. Establishing rules and procedures</li> <li>34. Organizing the physical layout of the classroom</li> <li>35. Demonstrating withitness</li> <li>36. Acknowledging adherence to rules and procedures</li> <li>37. Acknowledging lack of adherence to rules and procedures</li> </ol> <p><b>Building Relationships</b></p> <ol style="list-style-type: none"> <li>38. Using verbal and nonverbal behaviors that indicate affection for students</li> <li>39. Understanding students' backgrounds and interests</li> <li>40. Displaying objectivity and control</li> </ol> <p><b>Communicating High Expectations</b></p> <ol style="list-style-type: none"> <li>41. Demonstrating value and respect for reluctant learners</li> <li>42. Asking in-depth questions of reluctant learners</li> <li>43. Probing incorrect answers with reluctant learners</li> </ol>

## Curriculum Introduction

This curriculum document outlines the essential learning for this trade program and provides a clear structure for planning, instruction, and assessment. It includes the components required by NEASC Standard 2.2a, along with elements that reflect the unique nature of CTECS technical programs. The curriculum is organized to show what students learn in each course, how learning progresses across grade levels, and how instruction supports both technical skill development and the CTECS Vision of a Graduate.

Teachers should use this document to:

- Understand the overall structure and expectations of the course sequence
- Reference the Course Map to see the scope and sequence of Priority Standards and the alignment to District Summative Assessments (DSAs)
- Use the Priority Standards and Units of Study to guide daily, weekly, and cycle-based planning
- Integrate Big Ideas, Essential Questions, Skills/Learning Outcomes, vocabulary, and resources during lesson design
- Identify required safety, industry, and technical content expectations
- Plan and implement formative assessments to monitor progress and guide instruction
- Prepare students for the District Summative Assessments, ensuring alignment with the Course Map
- Maintain consistency of technical and professional practice instruction across campuses while adapting to student needs and industry-based opportunities

## Curriculum Components

### Course Map

A Course Map serves as the scope and sequence for this course by outlining the progression of instructional units and the standards that guide teaching and assessment. While each campus will have individual student needs, cycle schedules, and industry-based opportunities, all instructors are expected to teach the standards outlined in the Course Map. Using the Course Map below, teachers will intentionally plan learning experiences that prepare students to meet the identified standards within the designated assessment windows.

### Priority Standards (Unit of Study)

Priority Standards identify the most essential learning in the trade program. They reflect the core technical competencies, safety practices, and industry-aligned skills that require the greatest instructional focus and appear on program assessments. In CTE programs, each Priority Standard also functions as a Unit of Study, because it includes the required components such as big ideas, essential questions, content topics, and skills/learning outcomes aligned to assessments.

## **Vertical Alignment**

Vertical alignment shows how Priority Standards and instructional expectations progress from grade to grade within the trade program. It provides a clear pathway of skill development, increasing complexity, and technical proficiency across the four-year sequence.

## **Learning Outcomes**

Learning outcomes are what students will know (Concepts) and be able to do (Skills). Concepts identify the major content topics within the Priority Standard (Unit of Study). They appear in the left column of the Learning Outcomes table and follow a similar coding structure as the Priority Standard.

Skills are learning objectives that describe the measurable actions students must be able to perform to demonstrate proficiency. They appear in the right column of the Learning Outcomes table and show the progression of learning evidence in the Priority Standard.

## **Vocabulary**

Essential vocabulary includes the technical and academic terms students must understand and use accurately to engage in trade-specific learning and demonstrate proficiency on assessments. Vocabulary is foundational to safety, technical precision, and industry communication, and should be a primary initial focus within each unit and taught explicitly through modeling, demonstration, and repeated application.

## **Resources**

Resources include the tools, equipment, texts, materials, and digital tools that support learning within each unit and reflect industry standards.

## **Assessment Practices**

Teachers use ongoing formative assessments—such as questioning, checks for understanding, performance demonstrations, reflections, and teacher observation—to monitor progress, guide instruction, and support all learners in mastering the Priority Standards.

Each program also includes District Summative Assessments (DSAs), which measure proficiency on the Priority Standards identified in the Course Map. DSAs provide consistent evidence of student learning across campuses and ensure alignment to industry expectations, safety requirements, and program outcomes. Teachers should reference the Course Map and Units of Study when planning instruction to ensure students have opportunities to practice and demonstrate the skills and knowledge assessed on the DSA.

## **Welding & Metal Fabrication Philosophy**

The Welding and Metal Fabrication program is grounded in the belief that skilled trades are essential to the strength of our communities, infrastructure, and advanced manufacturing industries. We believe that students learn best through purposeful, hands-on experiences that combine technical knowledge, craftsmanship, problem-solving, and professional responsibility.

Our program emphasizes safety, precision, and quality as foundational principles. Students develop technical competency in welding processes, fabrication techniques, blueprint reading, metallurgy, and industry standards while building habits of accuracy, discipline, and attention to detail. We believe that mastery comes through practice, reflection, and continuous improvement.

Welding is both a science and a craft. Therefore, we integrate academic concepts such as mathematics, measurement, material properties, and technical communication into authentic shop applications. Students are challenged to think critically, work collaboratively, and solve real-world fabrication problems that mirror industry expectations.

We also believe that professional skills are as important as technical ability. Reliability, integrity, teamwork, and pride in workmanship define successful welders and fabricators. Through production work, project-based learning, industry partnerships, and work-based learning opportunities, students develop the confidence and competence required to enter apprenticeships, employment, military service, or post-secondary education.

# Welding and Metal Fabrication – Course Map

## Grade 9 – Semester 1 & 2 DSA

- [9.1 Shop Safety](#)
- [9.2 Career Readiness](#)
- [9.3 Hand Tools](#)
- [9.4 Abrasive Equipment](#)
- [9.5 Shielded Metal Arc Welding \(SMAW\)](#)
- [9.6 Gas Metal Arc Welding \(GMAW\)](#)
- [9.7 Introduction to Plasma Arc Cutting](#)
- [9.8 Introduction to Oxy-Fuel Cutting](#)
- [9.9 Basic Welding Math](#)
- [9.10 Welding Projects](#)

## Grade 10 – Semester 1 DSA

- [10.1 Shop/Site Safety \(OSHA10\)](#)
- [10.2 Shielded Metal Arc Welding \(SMAW\)](#)
- [10.3 Blueprint Reading](#)
- [10.4 Plasma Arc Cutting \(Advanced\)](#)
- [10.10 Welding Projects](#)

## Grade 10 – Semester 2 DSA

- [10.5 Gas Metal Arc Welding \(GMAW\)](#)
- [10.6 Oxy-Fuel Cutting \(Advanced\)](#)
- [10.7 Basic Welding Electricity](#)
- [10.8 Welding Math \(Advanced\)](#)
- [10.9 Introduction to Welding Procedure Specification](#)
- [10.10 Welding Projects](#)

## Grade 11 – Semester 1 DSA

- [11.1 Jobsite Safety](#)
- [11.2 Shielded Metal Arc Welding \(SMAW\)](#)
- [11.3 Measurements and Fabrication](#)
- [11.4 Gas Metal Arc Welding \(GMAW\)](#)
- [11.10 Welding Projects/Production](#)

## **Grade 11 – Semester 2 DSA**

- [11.5 Advanced Welding Procedures](#)
- [11.6 Gas Tungsten Arc Welding \(GTAW\)](#)
- [11.7 Pipe and Tube Welding](#)
- [11.8 Introduction to Flux Cored Arc Welding](#)
- [11.9 Introduction to Weld Inspection](#)
- [11.10 Welding Projects/Production](#)

## **Grade 12 – Semester 1 DSA**

- [12.1 Shop and Jobsite Safety](#)
- [12.2 Welding Tools and Equipment](#)
- [12.3 Blueprint Reading and Welding Math](#)
- [12.4 Shield Metal Arc Welding \(SMAW\)](#)
- [12.5 Gas Metal Arc Welding \(GMAW\)](#)
- [12.6 Gas Tungsten Arc Welding \(GTAW\)](#)
- [12.11 Welding Projects/Production](#)

## **Grade 12 – Semester 2 DSA**

- [12.7 Cutting Advanced Procedures \(PAC & OFC\)](#)
- [12.8 Pipe and Tube Welding Advanced](#)
- [12.9 Welder Certification Gas Metal Arc Welding](#)
- [12.10 Introduction to Gas Metal Arc Welding– Spray](#)
- [12.11 Welding Projects/Production](#)

## 9th Grade Curriculum

Priority Standard 9.1 - Shop Safety	
<b>Big Idea(s):</b> <ul style="list-style-type: none"> <li>● Safety is the responsibility of everyone in the shop.</li> <li>● Training and awareness can prevent injuries.</li> </ul>	
<b>Essential Question(s):</b> <ul style="list-style-type: none"> <li>● How can hazard awareness prevent accidents?</li> <li>● Who is ultimately responsible for a worker's safety?</li> </ul>	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>9.1.1 Safe Work Habits</b>	<ul style="list-style-type: none"> <li>● Identify Personal Protective Equipment</li> <li>● Demonstrate appropriate PPE use</li> <li>● Explain the importance of SDS in the shop</li> <li>● Follow shop safety rules</li> <li>● Maintain a clean work area/shop</li> <li>● Locate Emergency shut-offs in shop</li> <li>● Explain the importance of a GFCI</li> <li>● 100% on written safety test</li> </ul>
<b>9.1.2 Fire Safety</b>	<ul style="list-style-type: none"> <li>● Identify classes of fires</li> <li>● Locate fire extinguishers and blankets in shop</li> <li>● Identify types of extinguishers</li> <li>● Explain the process of extinguishing certain fires</li> <li>● 100% on written safety test</li> </ul>
<b>9.1.3 First Aid</b>	<ul style="list-style-type: none"> <li>● Describe procedures for dealing with various injuries.</li> </ul>

	<ul style="list-style-type: none"> <li>● Explain the dangers bloodborne pathogens</li> <li>● 100% on written safety test</li> </ul>
<p><b>9.1.4 Welding Specific Hazards</b></p>	<ul style="list-style-type: none"> <li>● List 7 hazards that exist in the welding shop</li> <li>● Demonstrate precautions taken to reduce electrical hazards</li> <li>● Examine work areas for potential trip and fall hazards</li> <li>● Explain how to prevent injuries from hot objects (quench the piece, use soapstone to write HOT, perform a ½ hour cool down)</li> </ul>
<p><b>Technical Vocabulary-</b> PPE, Dress Code, SDS, Fire Extinguisher. Fire Triangle, Bloodborne Pathogens, AED, Eye Wash Station, Emergency Shut-off, GFCI</p>	
<p><b>Resources -</b> Welding Fundamentals 6th Edition</p>	

## Priority Standard 9.2 - Career Readiness

### Big Idea(s):

- Soft skills are just as important, if not more, than technical skills.

### Essential Question(s):

- What are the essential personal and professional skills needed to be successful in Welding?
- How can soft skills help to increase the likelihood of success?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 9.2.1 Job Opportunities

- Research job opportunities in Welding
- List job requirements for entry-level employment in Welding

#### 9.2.2 Employability Skills

- Demonstrate good attendance
- Adhering to shop rules
- Demonstrate Professionalism
  - Dress code
  - Readiness
  - Hygiene

**Technical Vocab-** Professionalism, Organization, Critical thinking, communication skills, motivation.

**Resources-** <https://www.realityworks.com>, Welding Fundamentals 6th Edition

## Priority Standard 9.3 - Hand Tools

### Big Idea(s):

- Welders must be able to identify, select and safely use the appropriate tool for different jobs to be successful.
- Using hand tools can be just as dangerous as power tools.

### Essential Question(s):

- Why should you use the right tool for the job?
- What are possible repercussions of using the wrong tool for a job and using a tool incorrectly?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 9.3.1 Hand Tool Identification

- Identify common hand tools:
  - Measuring/Marking Tools
  - Slag Picks
  - Wire Brushes
  - Hammers, Punches, and Chisels
  - Squares
  - Clamps
- Explain hand tool uses
- Explain the advantage of using hand tools over power tools for certain tasks

#### 9.3.2 Safe Hand Tool Use

- Explain the importance of the appropriate tool for the job
- Explain the dangers of using a damaged tool
- Explain the importance of keeping tools sharp and clean
- Sharpen an edge tool
- Demonstrate safe use of hand tools
- 100% on Written Safety Test

**Technical Vocabulary-** Clamps, Welpers, Level, Hammer, Square, Punch, Wire Brush, Chisel, Measuring device, Soapstone

**Resources** - Welding Fundamentals 6th Edition

**Priority Standard 9.4 - Introduction to Abrasive Equipment**

**Big Idea(s):**

- It is essential to know how to select, safely use, and maintain the proper power tool for completion of the task at hand.
- Power tools enable the welder to do more work in less time and with less effort.

**Essential Question(s):**

- What factors should be considered when choosing power tools for a specific task?
- How can portable power tools affect time and quality on a project?

**Learning Outcomes**

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>9.4.1 Abrasive Tool Identification</b>	<ul style="list-style-type: none"> <li>● List and explain the use of various abrasive tools:                             <ul style="list-style-type: none"> <li>○ Handheld grinding machine</li> <li>○ Pedestal Grinder</li> <li>○ Cutting wheels</li> <li>○ Grinding Wheels</li> <li>○ Sanding discs</li> </ul> </li> <li>● Identify parts and functions of common grinding machines</li> <li>● Selects proper Abrasives for specific tasks</li> <li>● Choose and use abrasive equipment Safely</li> </ul>
<b>9.4.2 Abrasive Tool Safety Precautions</b>	<ul style="list-style-type: none"> <li>● Inspect tool for safe operation</li> <li>● List safety rules that apply to Abrasive tools</li> <li>● Demonstrate setup of proper use of abrasive tooling use</li> <li>● 100% on written and performance safety tests</li> </ul>
<b>9.4.3 Abrasive Tool Operation</b>	<ul style="list-style-type: none"> <li>● Identify various Grinding wheels, discs,</li> </ul>

	<p><b>and sanding discs</b></p> <ul style="list-style-type: none"><li>● <b>Demonstrate how to safely change:</b><ul style="list-style-type: none"><li>○ <b>Grinding Wheels</b></li><li>○ <b>Cutting Discs</b></li><li>○ <b>Sanding discs</b></li></ul></li><li>● <b>Demonstrate proper setup for different operations</b></li><li>● <b>Demonstrate safe use through shop projects</b></li></ul>
<p><b>Technical Vocabulary-</b> Abrasive, Arbor, Arbor hole, Chatter, Cut off wheel, Disc Grinder, Dressers, Finish, Grinding Wheel, Guards, R.P.M, Wheel speed, Work Surface,</p>	
<p><b>Resources -</b> Welding Fundamentals 6th Edition</p>	

## Priority Standard 9.5 - Shielded Metal Arc Welding (SMAW)

### Big Idea(s):

- Shielded Metal Arc Welding is useful in various aspects of construction and industry.
- Shielded Metal Arc Welding is an electric arc process that can be done outside in the elements.

### Essential Question(s):

- What is the value of using Shielded Metal Arc Welding in outdoor environments?
- What would be the best jobs to use Shielded Metal Arc Welding?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 9.5.1 Principles of Shielded Metal Arc

- Define Shielded Metal Arc Welding
- Identify the main differences from other processes
- Determine when it is appropriate to use Shielded Metal arc welding

#### 9.5.2 Equipment setup

- List common parts associated with Shielded Metal Arc Welding
- List safety rules that apply to Shielded Metal Arc
- describes process for dealing with damaged equipment
- Performs a safety ground check

#### 9.5.3 Equipment use

- Identify appropriate PPE required in SMAW cladding
- Set-up work station including checking for and removing burnables in the 35 foot hotwork boundary
- Determine appropriate amperage needed for specific task
- Strike an arc successfully

#### 9.5.4 Performance qualification

- Identify material needed for testing

	<ul style="list-style-type: none"><li>• Interpret the requirements of testing procedure(Amperage,wire feed, preheat)</li><li>• Prepare carbon steel for welding</li><li>• Produce welds with proper toe to crown weld placement</li></ul>
<b>Technical Vocabulary-</b> arc blow, arc length, chipping, drag angle, keyhole, porosity, restarts, root pass, inclusions, splatter, travel angle, electrode	
<b>Resources</b> - Welding Fundamentals 6th Edition	

## Priority Standard 9.6 - Gas Metal Arc Welding (GMAW)

### Big Idea(s):

- Gas Metal Arc Welding is a process used to increase production and lower overall cost.
- Gas Metal Arc Welding can be a difficult process to use out in the elements.

### Essential Question(s):

- What is the value of using Gas Metal Arc Welding in a production shop?
- To what extent does Gas Metal Arc Welding prevent challenges?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 9.6.1 Principles of Gas Metal Arc Welding

- Define Gas Metal Arc Welding
- Identify the main differences from other processes
- Identify when it is appropriate to use Gas Metal arc welding

#### 9.6.2 Equipment setup

- List all parts associated with Gas Metal Arc Welding
- List safety rules that apply to Gas Metal Arc Welding
- Describe process for dealing with damaged equipment
- Perform a safety ground check

#### 9.6.3 Equipment use

- Identify appropriate PPE required in SMAW cladding
- Check for and removes burnables in the 35 foot hotwork boundary
- Determine the appropriate amperage needed for specific task
- Run a bead while maintaining arc distance and travel speed

#### 9.6.4 Performance qualification

- Identify material needed for testing
- Interpret the requirements of testing procedure(Amperage,wire feed, preheat)

	<ul style="list-style-type: none"><li>● <b>Prepare carbon steel for welding</b></li><li>● <b>Produce welds with proper toe to crown weld placement</b></li></ul>
<b>Technical Vocabulary-</b> argon, carbon dioxide, consumable electrode, contact tube, drive rollers, Flow meter, gas nozzle, liner, welding gun, wire feeder	
<b>Resources-</b> Welding Fundamentals 6th Edition	

**Priority Standard 9.7 - Introduction to Plasma Arc Cutting (PAC)**

**Big Idea(s):**

- Plasma arc cutting is a process that is used to cut metal quickly and cleanly.
- Plasma arc cutting does not require the use of expensive fuel gas or bottled oxygen.

**Essential Question(s):**

- What is the value of using Plasma arc cutting over and Oxy Fuel setup?
- To what extent does Plasma arc cutting limit you in the field?

**Learning Outcomes**

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>9.7.1 Plasma arc cutting principles</b>	<ul style="list-style-type: none"> <li>● Describe the plasma arc cutting process</li> <li>● Contrast the differences between Plasma arc cutting and Oxy fuel cutting</li> <li>● Identify and use proper PPE for Plasma arc cutting</li> </ul>
<b>9.7.2 Equipment setup</b>	<ul style="list-style-type: none"> <li>● Describe the equipment needed to operate Plasma Arc cutting</li> <li>● Demonstrate proper identification and inspection of torch parts</li> <li>● Develop a list of cutting procedures for carbon steel depending on thickness.</li> </ul>
<b>9.7.3 Equipment Use</b>	<ul style="list-style-type: none"> <li>● Identify tooling needed to layout cuts</li> <li>● Properly layout lines needed to make a cut.</li> <li>● Demonstrate safe and proper cutting techniques</li> <li>● Perform 90 degree cut and restart cut in mild steel</li> <li>● Make a bevel cut on mild steel</li> </ul>

**Technical Vocabulary-** constricting nozzle, dross, gouging, heat shield, ionized, kerf, pilot arc, plasma, plasma arc cutting, plasma gas, preflow, swirl ring, transferred arc

**Resources-** Welding Fundamentals 6th Edition

## Priority Standard 9.8 - Introduction to Oxy-Fuel Cutting

### Big Idea(s):

- Proper oxy-fuel set up is essential to maintaining a safe work environment.
- Oxy-fuel equipment is used for cutting and heating metal and used in many aspects of the welding industry.
- Each person is responsible for following safety procedures

### Essential Question(s):

- What are the advantages and disadvantages of oxy-fuel cutting?
- Why is safety such an important concern in regard to oxy-fuel equipment?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
9.8.1 Oxy-Fuel Parts	<ul style="list-style-type: none"> <li>● List the parts that make up an oxy-fuel setup</li> <li>● Explain the functions of all the parts</li> <li>● Demonstrate knowledge of parts that make up an oxy-fuel setup</li> <li>● 100% on written safety test</li> </ul>
9.8.2 Oxy-Fuel Safety Precautions	<ul style="list-style-type: none"> <li>● List safe procedural storage of oxy fuel equipment</li> <li>● Demonstrate proper inspections of all parts</li> <li>● Demonstrate proper setup of oxy-fuel equipment</li> <li>● Successfully disassemble and store equipment</li> </ul>
9.8.3 Oxy-Fuel Set-Up	<ul style="list-style-type: none"> <li>● List hazards that exist with oxy fuel equipment</li> <li>● Recognize hot work procedures for oxy fuel use</li> <li>● Identify different types of flames</li> <li>● Interpret Oxy-fuel Operating Procedures</li> </ul>

	<ul style="list-style-type: none"> <li>● <b>Demonstrate safe setup and lighting of Oxy Fuel flames</b></li> <li>● <b>Perform shut down of equipment</b></li> </ul>
<p><b>9.8.4 Oxy-Fuel Operations</b></p>	<ul style="list-style-type: none"> <li>● <b>Identify tooling needed to layout cuts</b></li> <li>● <b>Properly layout lines needed to make a cut.</b></li> <li>● <b>Demonstrate safe and proper cutting techniques</b></li> <li>● <b>Perform 90 degree cut and restart cut in mild steel</b></li> <li>● <b>Make a bevel cut on mild steel</b></li> </ul>
<p><b>Technical Vocab-</b> acetylene, oxygen, flashback, infrared rays, orifice, preheat, regulator, working pressure</p>	
<p><b>Resources -</b> Welding Fundamentals 6th Edition</p>	

## Priority Standard 9.9 - Introduction to Basic Welding Math

### Big Idea(s):

- Being able to measure is an essential skill for an apprentice.
- Accurate measuring and layout are vital to the quality of a project.
- Effective planning is crucial to a project's success.

### Essential Question(s):

- How can measuring and math skills help to promote a Welder in a workplace?
- How can accurate blueprints/sketches and planning increase productivity?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 9.9.1 Measuring

- Identifying measurements with 1/16 accuracy
- Adding measurements (fractions)
- Subtracting measurements (fractions)
- Finding center (division)
- Identify the process of calculating board footage
- Calculate perimeter and area of regular and irregularly shaped rooms
- Calculate the volume of a variety of shapes
- Convert measurements (Fractions to Decimals)

#### 9.9.2 Welding Math

- Adding measurements (fractions)
- Subtracting measurements (fractions)
- Finding center (division)
- Identify the process of calculating board footage
- Calculate perimeter and area of regular and irregularly shaped rooms
- Calculate the volume of a variety of shapes
- Convert measurements (Fractions to Decimals)

<b>Technical Vocab-</b> Fractions, perimeter, board foot, converting, right angle, square, linear foot, dimension, sketch, scale, yield, cutlist	
<b>Resources -</b> Welding Fundamentals 6th Edition	

## Priority Standard 9.10 - Welding Projects

### Big Idea:

- Welding projects are a great way to demonstrate proficiency in competencies learned throughout the year
- Welding projects are great for tying together both theory and hands on skills

### Essential Question(s):

- What is the importance of “workmanship”?
- What are characteristics of an acceptable finishing of a project?
- Does the technique change based on the materials used?
- How does the application of employability skills affect the success of a project?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 9.10.1 Construct Projects

- Measuring
- Layout
- Hand Tools
- Stationary Machines
- Common Weld Joints
- Project Completeness

- Proficiency will be determined by scoring a 3 or greater on individual project/production proficiency scales in the following areas:
  - Measuring
  - Layout
  - Hand Tools
  - Cutting
  - Common Weld Joints
  - Project Completion
- Demonstrate behavior expected for career employability

#### 9.10.2 Welding Portfolio

- Uploading evidence of proficiencies completing project to portfolio
- Update the Competency Checklist

**Technical Vocab-** workmanship, competency, portfolio, resume

**Resources** - Welding Fundamentals 6th Edition



## 10th Grade Curriculum

Priority Standard 10.1 - Shop and Site Safety (OSHA 10)	
<b>Big Idea(s):</b> <ul style="list-style-type: none"> <li>● Safety needs to be a habit and a consideration throughout daily living as well as in the work environment.</li> <li>● OSHA oversees and regulates safety issues on the job site and the shop, protecting workers.</li> </ul>	
<b>Essential Question(s):</b> <ul style="list-style-type: none"> <li>● What are some of the benefits of safe work practices?</li> <li>● How can no lost time accidents benefit you as a business owner?</li> </ul>	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>10.1.1 Safe Work Habits</b> <ul style="list-style-type: none"> <li>● Shop Rules                             <ul style="list-style-type: none"> <li>○ Horseplay</li> <li>○ Dress code</li> </ul> </li> <li>● Housekeeping                             <ul style="list-style-type: none"> <li>○ Material Handling and Storage</li> </ul> </li> <li>● SDS</li> <li>● Emergency Shut-off</li> <li>● Electrical Safety                             <ul style="list-style-type: none"> <li>○ GFCI</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Identify Personal Protective Equipment</li> <li>● Demonstrate appropriate PPE use</li> <li>● Explain the importance of SDS in the shop</li> <li>● Follow shop safety rules</li> <li>● Maintain a clean work area/shop</li> <li>● Locate Emergency shut-offs in shop</li> <li>● Explain the importance of a GFCI</li> <li>● 100% on written safety test</li> </ul>
<b>10.1.2 PPE</b>	<ul style="list-style-type: none"> <li>● Identify Personal Protective Equipment                             <ul style="list-style-type: none"> <li>○ Welding Helmet</li> <li>○ Gloves</li> <li>○ Jacket</li> <li>○ High Top Leather Boots</li> <li>○ Safety Glasses</li> <li>○ Hearing Protection</li> </ul> </li> <li>● Demonstrate appropriate PPE use</li> <li>● Explain uses of different shade lenses                             <ul style="list-style-type: none"> <li>○ Cutting</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <b>Welding</b></li> <li>○ <b>General Shop Equipment</b></li> </ul>
<b>10.1.3 Fire Safety</b> <ul style="list-style-type: none"> <li>● <b>Classes of fires</b></li> <li>● <b>Fire Triangle</b></li> <li>● <b>Extinguisher Use</b></li> <li>● <b>Fire Blankets</b></li> <li>● <b>Fire Alarms / Evacuations</b></li> </ul>	<ul style="list-style-type: none"> <li>● <b>Identify classes of fires</b></li> <li>● <b>Locate fire extinguishers and blankets in shop</b></li> <li>● <b>Identify types of extinguishers</b></li> <li>● <b>Explain the process of extinguishing certain fires</b></li> <li>● <b>100% on written safety test</b></li> </ul>
<b>10.1.4 First Aid</b> <ul style="list-style-type: none"> <li>● <b>Injury Protocols</b></li> <li>● <b>AED/First Aid locations</b></li> <li>● <b>Eye Wash Station</b></li> <li>● <b>Bloodborne Pathogens</b></li> </ul>	<ul style="list-style-type: none"> <li>● <b>Describe procedures for dealing with various injuries.</b></li> <li>● <b>Explain the dangers bloodborne pathogens</b></li> <li>● <b>Appropriate contact person</b></li> <li>● <b>100% on written safety test</b></li> </ul>
<b>10.1.5 OSHA-10 - 1910 General Industry</b>	<ul style="list-style-type: none"> <li>● <b>Complete OSHA-10 - 1910 General Industry safety training.</b></li> <li>● <b>Obtain OSHA-10 - 1910 General Industry certification</b></li> </ul>
<b>Technical Vocabulary-</b> Hazard, Safety, Focus, Competent, Leadership, Organized, Responsible, OSHA, PPE, Demonstrate, Push stick, jig, tool guard. First Aid	
<b>Resources-</b> OSHA 10 Training Module, Welding Fundamentals: Chapter 2 - Safety in the Welding Shop (pg. 19-34)	

## Priority Standard 10.2 - Shielded Metal Arc Welding (SMAW)

### Big Idea(s):

- Shielded Metal Arc Welding Can be used in multiple positions.
- Shielded Metal Arc can be a useful process in hard to get to places.

### Essential Question(s):

- To what extent do angles affect a fillet weld?
- What is the value of using SMAW over GMAW for fillet welds?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
10.2.1 P.P.E. for SMAW	<ul style="list-style-type: none"> <li>• Recall the basic PPE from flat SMAW welding</li> <li>• Evaluate the need for added PPE in out of position welding vs flat welding</li> <li>• Inspect PPE for damage</li> <li>• Use PPE properly</li> </ul>
10.2.2 Fillet weld positions	<ul style="list-style-type: none"> <li>• List the four basic fillet weld positions</li> <li>• Explain work angle and travel angle</li> <li>• Construct a list of of angles for each position</li> </ul>
10.2.3 Fillet weld joint types	<ul style="list-style-type: none"> <li>• List the 3 types of fillet weld joints</li> <li>• Discuss bead planning patterns</li> <li>• Compare the differences in concave and convex weld profiles</li> <li>• Identify defects that occur for out of position welding</li> </ul>
10.2.4 Fillet weld performance qualification	<ul style="list-style-type: none"> <li>• Identify the material needed for testing</li> <li>• Interpret the requirements of testing procedure (Amperage,wire feed, preheat)</li> <li>• Prepare carbon steel for welding</li> <li>• Weld a 2F/3F/4F to requirements,( 2F/4F- <math>\frac{3}{8}</math>" fillet weld minimum)(3F fillet weld- <math>\frac{1}{2}</math> minimum fillet)</li> </ul>

**Technical Vocab-** Uphill welding, Down hill welding, lap joint, t-joint, corner joint, horizontal, vertical, overhead, root bead, intermediate bead, finish bead, Heat Input, Bead Planning

**Resources-** Welding Fundamentals: Chapter 9 - SMAW: Equipment and Supplies (127-130), Chapter 10 - SMAW: Equipment Assembly and Adjustment (143-147), Chapter 11 - SMAW: Electrodes (153-161), Chapter 12 - SMAW: Flat Welding Position (pg. 167-180), Chapter 13 SMAW Horizontal, Vertical, and Overhead (185-196)

## Priority Standard 10.3 - Blueprint Reading

### Big Idea(s):

- Blueprints are used in Manufacturing to build and install .
- Blueprints describe everything you need to know about the job.

### Essential Question(s):

- How do blueprints aid the fabrication process?
- What is the purpose of a detailed drawing?
- How do Isometric drawings aid in building?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 10.3.1 Information Location

- Locate page numbers and title from Title block.
- Identify revision numbers
- Identify proper pages.
- Locate appropriate drawings for each task

#### 10.3.2 Interpreting Information.

- Interpret weld symbols from drawing.
- Perform proper welds from drawing information

#### 10.3.3 Creating from Blueprints.

- Draft drawings to specific scale.
- Analyze and create from Blueprints.
- Interpret prints to direct others.

**Technical Vocab-** Isometrics, Weld symbols, Index, Title Block, Manufacturing, Installation, Elevations, Scaled, Grid, Views

**Resources-** Welding Fundamentals: Chapter 7 - Weld Joints and Positions (pg. 91-99), Chapter 28 - Welding Symbols (pg. 107-119)

## Priority Standard 10.4 - Plasma Arc Cutting (Advanced)

### Big Idea(s):

- PAC is becoming a industry standard
- PAC Can be used on a wide range of materials

### Essential Question(s):

- What are the basic principles of PAC
- What are the limits of Plasma Arc Cutting

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 10.4.1 Plasma Track Burner

- Identify parts of a track cart
- Select proper travel speeds for material thickness
- Set proper air pressure for material

#### 10.4.2 Bevel with PAC

- Explain the reason for proper bevel
- Identify the proper parts to obtain accurate bevel
- Evaluate cut quality

#### 10.4.3 Planning for cutting

- Explain gas use for different metals
- Modify equipment for gouging and angle cuts.
- Test for proper outcomes with different metal and gas combinations.

#### 10.4.4 Advanced Beveling

- Choose proper feeds for cutting
- Create different bevels for weld fit-up
- Improve cut surface for welding

**Technical Vocabulary-** Constricting Nozzle, Dross, Gouging, Heat shield, Ionized, kerf, non-transferred arc, pilot arc, plasma, plasma arc cutting(PAC), plasma gas, preflow, swirl ring, transferred arc.

**Resources-** Welding Fundamentals: Chapter 23 - Plasma Arc Cutting (pg. 335-346)

## Priority Standard 10.5 - Gas Metal Arc Welding (GMAW)

### Big Idea(s):

- GMAW is used in production welding
- GMAW has different modes of transfer

### Essential Question(s):

- What is the benefit of using Gas Metal Arc Welding compared to other processes?
- What Limits does Gas Metal Arc Welding have in the field?

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 10.5.1 GMAW equipment

- Identify steps for setting up equipment
- Select different processes
- Interpret erratic arc

#### 10.5.2. T-joint angles

- Explain what is a fillet weld.
- Identify proper bead discontinuities.
- Inspect weld beads for correct angles

#### 10.5.3 Out of position welding (GMAW)

- Explain best practices for out of position welding.
- Discuss ways to minimize weld defects
- Identify solution for erratic welding arc (high level)

**Technical Vocabulary-** Backhand welding, Backing, Contact to work distance, Drag angle, Electrode Extension, Stick-out, Push angle, Root pass

**Resources-** Welding Fundamentals: Chapter 9 - SMAW: Equipment and Supplies (pg. 127-130), Chapter 15 - Gas metal and Flux cored arc welding (pg. 209-228), Chapter 16 - GMAW Equipment Assembly and Adjustment:(pg 229-246), Chapter 17 - GMAW: Flat Welding Position (pg. 247-262), Chapter 18 - GMAW: Horizontal, Vertical, and Overhead Welding Positions (pg. 263-275)

## Priority Standard 10.6 - Oxy-Fuel Cutting (Advanced)

### Big Idea(s):

- Oxy fuel cutting is used for heavy material preparation.
- Oxy fuel cutting can be done in remote location

### Essential Question(s):

- When is Oxy-fuel cutting the preferred Method
- How is Oxy-fuel cutting being used in today's Industry

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 10.6.1 Oxy-Fuel Setup

- Demonstrate proper setup of equipment for safe operation.
- Safely demonstrate torch operation
- Evaluate kerf pattern to obtain acceptable cut
- 100% on written safety for handling of Oxy acetylene gasses and equipment

#### 10.6.2 Oxy-Fuel Beveling

- Using torch manually cut Clean Bevel at 22.5 degrees
- Perform a manual 45 degree bevel

#### 10.6.3 Oxy-Fuel Piercing

- Perform proper torch pierce in material
- Cut hole to proper size

#### 10.6.4 Oxy-Fuel Notching

- Cope and notch material for proper fit of angle iron

**Technical Vocabulary-** Bell-mouth kerf, burning, hard slag, ignition temperature, kerf, preheating

**Resources-** Welding Fundamentals: Chapter 3 - Welding and Cutting Processes (pg. 35-39), Chapter 24 - Oxyfuel Gas and Welding: Equipment and Supplies (pg. 351-370), Chapter 25 - Oxyfuel Gas and Welding: Equipment Assembly and Adjustment (pg. 377-389), Chapter 26 - Oxyfuel Gas Cutting (pg. 393-401)

## Priority Standard 10.7 - Basic Welding Electricity

### Big Idea(s):

- Power grid Electricity allows for fast Production
- Generator Power is mobile

### Essential Question(s):

- How does the Power grid increase Productivity?
- What are the benefits of generator power?
- What are some drawbacks?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 10.7.1 Setup of welding

- Set up a welding machine in a booth properly
- Identify quality ground location
- Identify proper polarity for weld process

#### 10.7.2 Electric Principals

- Explain how current flows
- Describe amperage in welding
- Explain resistance in welding

#### 10.7.3 Current

- Explain Direct current (DCEP, DCEN)
- Explain alternating Current (AC)

**Technical Vocabulary-** Amperage, Resistance, Ground, Electrode, Current, AC, DC, Duty cycle

**Resources-** Welding Fundamentals: Chapter 4 Physics of welding (pgs 47 - 57), Chapter 9 SMAW (Equipment and Supplies)pgs 127-139, Chapter 10 SMAW(equipment assembly and adjustment) pgs 153-163

## Priority Standard 10.8 - Welding Math Advanced

### Big Idea(s):

- Welders must have knowledge of mathematical equations to be able to successfully measure and cut parts for weldments.

### Essential Question(s):

- What is the value of performing measurements accurately?
- To what extent does mathematics have value in welding?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>10.8.1 Measuring</b>	<ul style="list-style-type: none"> <li>• Adding Measurements(fractions)</li> <li>• Subtracting fractions(fractions)</li> <li>• Calculate material length</li> <li>• Calculate area of shapes</li> <li>• Find center(Division)</li> <li>• Check accuracy of wire feeder</li> </ul>
<b>10.8.2 Scale Drawings</b>	<ul style="list-style-type: none"> <li>• Identify lines of drawings               <ul style="list-style-type: none"> <li>○ Hidden</li> <li>○ Center</li> <li>○ Edge</li> </ul> </li> <li>• Create rough sketch of Project with measurements</li> </ul>
<b>10.8.3 Layout</b>	<ul style="list-style-type: none"> <li>• Demonstrate proper layout of shop projects</li> <li>• Analyze layout for errors</li> <li>• Layout steel for minimal waste</li> </ul>

**Technical Vocabulary-** Square, Fractions, Align, Scale, Area, Dimension, Pythagorean Theorem, Right angle Triangle

**Resources-** Welding Fundamentals: Chapter 5 Math for Welding (pgs 59 -74), Chapter 6 Math applications for Welders (pgs 75-90)

**Priority Standard 10.9 - Introduction to Welding Procedure Specification**

**Big Idea(s):**

- Welding procedures are a safeguard to ensure the welder is working within the standards defined for the process being welded.
- Welding procedures are an important part of daily welding jobs.

**Essential Question(s):**

- What is the value of interpreting a welding procedure?
- Why do we want to follow a welding procedure?

**Learning Outcomes**

*Students will know:*

*As evidenced by: (oral, written, or performance)*

**10.9.1 Welding Procedures Specification**

- Name the purpose of a welding procedure specification
- List information found on a Welding Procedure Specification
- Setup a machine per the requirements of a welding procedure

**10.9.2 Preheat and Interpass temperature**

- Explain Preheat and Interpass temperature
- Demonstrate preheat
- Measure interpass temperature

**10.9.3 Joules Formula**

- Identify the Joules formula
- Demonstrate knowledge of multiplication and division
- Perform calculations on weldments ½" thick or less.

**Technical Vocabulary-** Base Metal, Root Opening, Groove, Technique, Filler Metal, Shielding gas, WPS, Polarity, Voltage, Amperage Electrode, Preheat, Inter-pass

**Resources-** Welding Fundamentals: Chapter 37 Welder Certification (pgs 577-588)

## Priority Standard 10.10 - Welding Projects

### Big Idea:

- Apply advanced skills to the completion of shop projects.
- Welding projects are a great way to demonstrate proficiency in competencies learned throughout the year
- Welding projects are great for tying together both theory and hands on skills

### Essential Question(s):

- What is the importance of “workmanship”?
- What is the importance of learning advanced welding skills?
- What are characteristics of an acceptable finishing of a project?
- Does the technique change based on the materials used?
- How does the application of employability skills affect the success of a project?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 10.10.1 Construct Projects

- Measuring
- Layout
- Hand Tools
- Stationary Machines
- Common Weld Joints
- Project Completeness

- Proficiency will be determined by scoring a 3 or greater on individual project/production proficiency scales in the following areas:
  - Measuring
  - Layout
  - Hand Tools
  - Cutting
  - Common Weld Joints
  - Project Completion
- Demonstrate behavior expected for career employability

#### 10.10.2 Welding Portfolio

- Uploading evidence of proficiencies completing project to portfolio
- Update the Competency Checklist

**Technical Vocab-** workmanship, competency, portfolio, resume

**Resources** - Welding Fundamentals 6th Edition

## 11th Grade Curriculum

Priority Standard 11.1 - Shop and Jobsite Safety	
<b>Big Idea(s):</b> <ul style="list-style-type: none"> <li>● Safety is the responsibility of everyone on the job.</li> <li>● Training and awareness can prevent injuries.</li> <li>● Produce sound projects safe and efficient</li> </ul>	
<b>Essential Question(s):</b> <ul style="list-style-type: none"> <li>● What safety hazards should workers be aware of?</li> <li>● How does one worker's action affect the other workers on a jobsite?</li> </ul>	
Learning Outcomes	
<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>11.1.1 Review of safe work habits:</b> <ul style="list-style-type: none"> <li>● Hand Tools,</li> <li>● Personal Safety</li> <li>● Job-Site Safety</li> <li>● SDS</li> <li>● Other</li> </ul>	<ul style="list-style-type: none"> <li>● Demonstrate safe practices.</li> <li>● Evaluate construction site work areas for potential hazards.</li> <li>● Explain the consequences of unsafe working conditions in construction.</li> <li>● Demonstrate the safe handling of hand tools.</li> <li>● Advocate for your personal safety.</li> <li>● Score 100% on the written Safety Test and hands-on assessment as new tools and equipment are introduced.</li> </ul>
<b>11.1.2 Review of Fire Safety Procedures</b> <b>Locate:</b> <ul style="list-style-type: none"> <li>● Fire alarms</li> <li>● Fire extinguishers</li> <li>● Eye wash stations</li> <li>● Power shut offs</li> <li>● Fire exits</li> <li>● Hot work</li> <li>● Other</li> </ul>	<ul style="list-style-type: none"> <li>● Locate fire alarms, fire extinguishers, eye wash stations, and power shut-offs.</li> <li>● Identify types of fires.</li> <li>● Describe the fire triangle.</li> <li>● Explain the protocol for extinguishing fires.</li> <li>● Score 100% on the written safety test.</li> </ul>

<b>11.1.3 First Aid Awareness</b>	<ul style="list-style-type: none"> <li>● Identify appropriate practices for administering first aid.</li> <li>● Explain the procedures for dealing with various injuries on outside production.</li> <li>● Explain the dangers of blood borne pathogens.</li> </ul>
<b>11.1.4 Personal Protective Equipment Including:</b> <ul style="list-style-type: none"> <li>● Hard hat</li> <li>● Safety glasses</li> <li>● Hearing protection</li> <li>● Respirators/Dust Masks</li> <li>● Safety shoes</li> <li>● Gloves</li> <li>● Other</li> </ul>	<ul style="list-style-type: none"> <li>● Identify common types of PPE</li> <li>● Select appropriate PPE</li> <li>● Demonstrate appropriate use of PPE</li> </ul>
<b>11.1.5 Ladder and Scaffold Safety</b> <ul style="list-style-type: none"> <li>● Step ladders</li> <li>● Extension ladders</li> <li>● Pipe staging</li> <li>● Ladder jacks</li> <li>● Other</li> </ul>	<ul style="list-style-type: none"> <li>● Identify common types of ladders and scaffolds.</li> <li>● Inspect equipment for damage or defects.</li> <li>● Set-up ladders and scaffolding in the school setting and on the job site safely.</li> <li>● Appropriately utilize safe practices while using equipment.</li> <li>● 100% on written and performance safety tests.</li> </ul>
<b>11.1.6 Fall Protection Systems</b> <ul style="list-style-type: none"> <li>● Personal fall arrest system <ul style="list-style-type: none"> <li>○ connector</li> <li>○ 5-point harness</li> <li>○ anchor point</li> </ul> </li> <li>● Guard rails</li> <li>● Safety nets</li> </ul>	<ul style="list-style-type: none"> <li>● Identify components of each fall protection system.</li> <li>● Describe the process of setting up fall protection systems.</li> <li>● Setup and use a personal fall arrest system.</li> </ul>
<b>11.1.7 Material Handling</b>	<ul style="list-style-type: none"> <li>● Identify safe lifting practices.</li> </ul>

	<ul style="list-style-type: none"><li>• <b>Demonstrate safe lifting practices.</b></li></ul>
<b>Technical Vocabulary</b> - braces, competent person, extension ladder, fall protection, guard rails, OSHA, PPE, SDS, staging, step ladder hotwork, fire watch, hotwork permit,	
<b>Resources</b> - Welding Fundamentals: Chapter 2 - Safety in the Welding Shop (pg. 19-34)	

## Priority Standard 11.2 - Shielded Metal Arc Welding (SMAW) Advanced

### Big Idea (s):

- Groove joints are very common in Shielded Metal Arc Welding
- Groove joints are used in many tests and certifications along with many job specific weld procedures.

### Essential Question (s):

- In what case do you think a groove weld would be the best welding joint for the job and why?

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
11.2.1 P.P.E. For SMAW	<ul style="list-style-type: none"> <li>● Describe a variety P.P.E. for SMAW</li> <li>● Demonstrate the use of P.P.E. appropriately for the given tasks</li> </ul>
11.2.2 Common Groove Weld Types	<ul style="list-style-type: none"> <li>● List 4 groove joints</li> <li>● Discuss the reason for an open root vs. closed root</li> <li>● Sketch weld a symbol for each of the 4 groove joints listed.</li> <li>● Select one weld joint to build</li> <li>● Construct the weld joint as a shop project</li> </ul>
11.2.3 Multi-Pass Groove Welds	<ul style="list-style-type: none"> <li>● Define when a multi pass groove weld would be necessary</li> <li>● Explain why it's critical to place weld beads in the correct pattern in a multi pass groove weld.</li> <li>● Sketch a numbered bead pattern layout for a 20 pass single V-groove weld.</li> <li>● Discuss the importance of bead planning</li> <li>● Evaluate a multi-pass groove weld that</li> </ul>

	<p>was not welded in the correct order</p> <ul style="list-style-type: none"> <li>• Construct a multi-pass groove weld with proper bead placement</li> </ul>
11.2.4 SMAW Groove Weld Certifications	<ul style="list-style-type: none"> <li>• State 2 common groove weld tests</li> <li>• Describe why a welder would benefit from being certified</li> <li>• Interpret the reason for different thicknesses of testing materials</li> <li>• Compare the qualities of the 2 weld tests</li> <li>• Complete D1.1 single V groove weld test</li> </ul>
<p><b>Technical Vocabulary-</b> Bevel, Cover pass, effective throat, face reinforcement, groove angle, groove face, groove weld, multiple pass weld, root face, root reinforcement, D1.1</p>	
<p><b>Resources -</b> Welding Fundamentals: Chapter 12 - SMAW: Flat Welding Position (pg. 167-180), Chapter 13 - SMAW: Horizontal, vertical, and overhead positions (185-196)</p>	

## Priority Standard 11.3 - Measurement and Fabrication

### Big Idea (s):

- Proper use and care of all tools is essential to maintaining a safe work environment and working efficiently.

### Essential Question (s):

- What type of knowledge does a worker need to properly choose the correct tools and equipment for a task?
- Why is safety such an important concern in regard to tools and equipment?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 11.3.1 Hand Tools

- Identify common welding shop hand tools and describe their purpose or function:
  - Wrenches
  - Saws
  - Files
  - Hand taps/dies (threading)
  - Hammers
  - Clamps
  - Vises
  - Pliers
  - Screwdrivers

#### 11.3.2 Hand Tool Use and Care

- Select the appropriate hand tool for a specific application
- Demonstrate the proper safe use and care of each hand tool during a performance assessment

#### 11.3.3 Power Tools

- Identify common shop power tools and describe their purpose or function:
  - Drills
  - Saws
  - Grinders/Sanders
  - Metal Forming tools

<p><b>11.3.4 Power Tool Use and Care</b></p>	<ul style="list-style-type: none"> <li>● <b>Select the appropriate power tool for a specific application</b></li> <li>● <b>Demonstrate the proper safe use and care of each power tool during a performance assessment</b></li> </ul>
<p><b>11.3.5 Welding Equipment</b></p>	<ul style="list-style-type: none"> <li>● <b>Identify common shop Equipment and describe their purpose or function:</b> <ul style="list-style-type: none"> <li>○ <b>Drill Press</b></li> <li>○ <b>Bandsaws</b></li> <li>○ <b>Grinders/Sanders</b></li> <li>○ <b>Benders</b></li> <li>○ <b>Ironworkers</b></li> <li>○ <b>Shears</b></li> <li>○ <b>Lifting and moving</b></li> </ul> </li> <li>● <b>Demonstrate the proper safe use and care of each piece of welding equipment during a performance assessment.</b></li> </ul>
<p><b>11.3.6 Fabrication Skills</b></p>	<ul style="list-style-type: none"> <li>● <b>Utilize square and leveling tools properly</b></li> <li>● <b>Identify angles and degrees properly</b></li> <li>● <b>Measure to a 1/16th of an inch</b></li> </ul>
<p><b>Technical Vocabulary</b> - square, plumb, level, pitch, miter, english wheel, shear, break,</p>	
<p><b>Resources-</b> Welding Fundamentals 6th Edition</p>	

## Priority Standard 11.4 - Gas Metal Arc Welding (GMAW) Advanced

**Big Idea(s):**

- GMAW is used in production welding
- GMAW has different modes of transfer

**Essential Question(s):**

- What is the benefit of using Gas Metal Arc Welding compared to other processes?
- What Limits does Gas Metal Arc Welding have in the field?

*Students will know:*

*As evidenced by: (oral, written, or performance)*

**11.4.1 GMAW equipment**

- Identify steps for setting up equipment
- Select the appropriate process for a specific job.
- Interpret erratic arc

**11.4.2. T-joint angles**

- Identify what is a fillet weld.
- Identify proper bead discontinuities.
- Inspect weld beads for correct angles

**11.4.3 Out of position welding (GMAW)**

- Identify best practices for out of position welding.
- Discuss ways to minimize weld defects
- Evaluate solutions for erratic welding arc

**Technical Vocabulary-** Backhand welding, Backing, Contact to work distance, Drag angle, Electrode Extension, Stick-out, Push angle, Root pass

**Resources-** Welding Fundamentals 6th Edition

## Priority Standard 11.5 - Advanced Welding Procedures

### Big Idea(s):

- Welding procedures are used daily in the welding world.
- Following welding procedures is crucial to performing acceptable welds

### Essential Question(s):

- To what extent does following a weld procedure produce acceptable welds?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>11.5.1 Safety Procedures</b>	<ul style="list-style-type: none"> <li>● List the safety items needed for welding</li> <li>● Perform inspections on all parts of equipment</li> <li>● Gather all necessary safety gear needed</li> </ul>
<b>11.5.2 Basic tools needed</b>	<ul style="list-style-type: none"> <li>● List tools needed(temp sticks, slag pick, wire brush, ect.)</li> <li>● Gather tools required</li> <li>● Inspect tools for damage</li> </ul>
<b>11.5.3 Material</b>	<ul style="list-style-type: none"> <li>● Identify factors of material cleanliness</li> <li>● Prepare metal to acceptable standards</li> <li>● Ensure material being welded is the correct material</li> <li>● Ensure all pieces are per the drawing specification</li> </ul>
<b>11.5.4 Weld machine settings</b>	<ul style="list-style-type: none"> <li>● Research the procedure for weld machine settings</li> <li>● Set the machine to the appropriate weld mode</li> <li>● Adjust machine accordingly for voltage</li> </ul>

**Technical Vocab** - WPS, base metal, joint details, post heat treatment, preheat temperature, interpass temperature, PQR.

**Resources**- Welding Fundamentals: Chapter 37 welder certification pg. (577-589), Appendix A sample Welding procedure specification.

**Priority Standard 11.6 - Introduction Gas Tungsten Arc Welding (GTAW)**

**Big Idea(s):**

- Gas Tungsten Arc Welding is a process that does not produce sparks, spatter, or fumes.
- Gas Tungsten Arc Welding is a slower process but creates higher quality and cleaner welds.

**Essential Question(s):**

- To what extent is GTAW different from other Arc welding processes?
- What is the value of having a higher quality weld?

**Learning Outcomes**

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>11.6.1 The principles of Gas tungsten Arc Welding</b>	<ul style="list-style-type: none"> <li>• Define Gas Tungsten Arc Welding</li> <li>• Identify the main differences from other processes.</li> <li>• Determine where Gas Tungsten Arc Welding is used the most in industry and why</li> </ul>
<b>11.6.2 Equipment Setup</b>	<ul style="list-style-type: none"> <li>• List all parts associated with Gas Tungsten Arc Welding</li> <li>• List safety rules that apply to Gas Tungsten Arc Welding</li> <li>• Make minor repairs if needed or tells the instructor of deficient conditions</li> <li>• Perform a safety ground check</li> </ul>
<b>11.6.3 Equipment Use</b>	<ul style="list-style-type: none"> <li>• List all PPE required while using this process</li> <li>• Sharpen Tungsten properly</li> <li>• Use correct collet for tungsten</li> <li>• Set Gas to the appropriate setting</li> <li>• determines appropriate amperage needed for specific task</li> </ul>

	<ul style="list-style-type: none"> <li>● Perform a success bead without the use of wire maintaining a consistent weld bead</li> <li>● Produce welds with proper toe to crown weld placement</li> </ul>
<p><b>11.6.4 Performance Qualification</b></p>	<ul style="list-style-type: none"> <li>● Identify material needed for testing</li> <li>● Interpret the requirements of testing procedure(Amperage,wire feed, preheat)</li> <li>● Prepare carbon steel for welding</li> <li>● Produce welds with proper toe to crown weld placement before testing</li> </ul>
<p><b>Technical Vocabulary-</b> ceria, thoria, zirconia, collet. gas lens, heliarc, post flow, pulsed current, tungsten</p>	
<p><b>Resources-</b> Welding Fundamentals: Chapter 19 GTAW equipment and supplies pg.(277-290), Chapter 20 GTAW Equipment assembly and adjustments pg.(291-304), Chapter 21 GTAW Flat welding position pg. (305-322)</p>	

## Priority Standard 11.7 - Introduction to Pipe and Tube Welding

### Big Idea(s):

- Pipe and Tube is used in almost every aspect of metalworking and fabricating. Welding it properly and safely is an essential skill for the welder.

### Essential Question(s):

- What determines the process and technique used to weld pipe and tube?
- How does the welding position affect the way the pipe is welded?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>11.7.1 Material Classification</b>	<ul style="list-style-type: none"> <li>• Identify the differences between pipes and tubes during a performance assessment</li> <li>• Identify sizes and classification of pipe and tubular metals</li> </ul>
<b>11.7.2 Process Positions</b>	<ul style="list-style-type: none"> <li>• Identify the positions for both groove and fillet welds on a written assessment</li> <li>• Explain the different groove positions for pipe welding</li> </ul>
<b>11.7.3 Techniques for uphill and downhill welding</b>	<ul style="list-style-type: none"> <li>• Demonstrate the technique used for uphill and downhill welding on a practical assessment</li> </ul>
<b>11.7.4 Procedures and Techniques using SMAW</b>	<ul style="list-style-type: none"> <li>• Weld an open root pipe joint using 6010 electrodes in the 2g position</li> <li>• Weld a closed root pipe joint using 7018 electrodes in the 2g position</li> </ul>
<b>11.7.5 Procedures and techniques used to weld pipes or tubes using GTAW</b>	<ul style="list-style-type: none"> <li>• Weld an open root pipe joint using the GTAW process in the 1g rotated position</li> <li>• Weld an open root pipe joint using the GTAW process in the 2g position</li> </ul>

**11.7.6 Procedures and techniques used to weld pipes or tubes using GMAW**

- **Weld an open root pipe joint using the GMAW process in the 1G and 2G position**

**Technical Vocabulary-** Backing Ring, Consumable insert, Convex Concave, Cover Pass, Outside Diameter, Inside Diameter, Tube, Root Pass

**Resources-** Welding Fundamentals 6th Edition

## Priority Standard 11.8 - Introduction to Flux Cored Arc Welding (FCAW)

### Big Idea(s):

- Flux Cored Arc Welding are welding processes that are used to increase production and lower costs

### Essential Question(s):

- When is the best time to use GMAW over other welding processes?
- What is the appropriate operation to run G.M.A.W. safely?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>11.8.1 Equipment and Accessories Used in FCAW</b>	<ul style="list-style-type: none"> <li>● Perform safety inspections of FCAW equipment and accessories</li> <li>● Make minor external repairs to FCAW equipment and accessories</li> </ul>
<b>11.8.2 Components of an arc welding outfit and potential hazards</b>	<ul style="list-style-type: none"> <li>● Identify all of the parts of an arc welding outfit and its functions</li> <li>● Describe potential electrical hazards</li> <li>● 100% on written safety test</li> </ul>
<b>11.8.3 Voltage and Wire Speed Settings</b>	<ul style="list-style-type: none"> <li>● Describe voltage and wire speed settings</li> <li>● Proper set up of a FCAW machine relative to the material being welded</li> <li>● Demonstration of knowledge with both a written and hands on assessment</li> </ul>
<b>11.8.4 Safety Inspections of equipment, PPE, and Work Area</b>	<ul style="list-style-type: none"> <li>● Perform safety inspections of FCAW equipment and accessories</li> <li>● Make minor external repairs to FCAW equipment and accessories</li> </ul>
<b>11.8.5 Principles of FCAW</b>	<ul style="list-style-type: none"> <li>● Set up for FCAW operations on carbon steel</li> <li>● Operate FCAW equipment on carbon steel</li> <li>● Make fillet weld in all positions on</li> </ul>

	<p><b>carbon steel</b></p> <ul style="list-style-type: none"> <li>• <b>Make groove welds, in all positions, on carbon steel</b></li> </ul>
<b>11.8.6 P.P.E. and safety for out of position welding</b>	<ul style="list-style-type: none"> <li>• <b>Recall the basic PPE from flat GMAW welding</b></li> <li>• <b>Contrast the need for added PPE in out of position welding vs flat welding</b></li> <li>• <b>Evaluate PPE for damage</b></li> <li>• <b>Wear PPE correctly</b></li> </ul>
<b>11.8.7 Groove weld positions</b>	<ul style="list-style-type: none"> <li>• <b>List the four basic groove weld positions</b></li> <li>• <b>Explain work angle and travel angle</b></li> <li>• <b>Construct a list of of angles for each position</b></li> </ul>
<b>11.8.8 Groove weld joint types</b>	<ul style="list-style-type: none"> <li>• <b>List the different types of groove joint configurations</b></li> <li>• <b>Discuss bead planning patterns</b></li> <li>• <b>Compare concave and convex welds</b></li> <li>• <b>Discuss the defects that occur for out of position welding</b></li> </ul>
<b>11.8.9 Groove weld performance qualification</b>	<ul style="list-style-type: none"> <li>• <b>Identify material needed for testing</b></li> <li>• <b>Interpret the requirements of testing procedure(Amperage,wire feed, preheat)</b></li> <li>• <b>Prepare carbon steel for welding</b></li> <li>• <b>Performs a success weld, 1G/2G to requirements to AWS standards</b></li> </ul>
<p><b>Technical Vocabulary-</b> Uphill welding, down hill welding, groove angle, bevel angle, root penetration, root opening, land, face, maximum reinforcement, horizontal, vertical, overhead, root bead, intermediate bead, finish bead, arc blow, arc length, chipping, drag angle, keyhole, porosity, restarts, root pass, inclusions, splatter, travel angle, electrode</p>	
<p><b>Resources:</b> Welding Fundamentals: Chapter 9 - SMAW: Equipment and Supplies (pg. 127-130), Chapter 10 - SMAW: Equipment Assembly and Adjustment (pg. 143-147), Chapter 11 - SMAW: Electrodes (pg. 153-161), Chapter 12 - SMAW: Flat Welding Position (pg. 167-180), Chapter 2 - SMAW: Horizontal, Vertical, and Overhead Welding Positions (pg. 185-193)</p>	

## Priority Standard 11.9 - Intro to Weld Inspection

### Big Idea(s):

- Non Destructive testing is a process used to test weld quality without disturbing the weld.
- Non Destructive testing is crucial to maintaining standards of weld quality.

### Essential Question(s):

- What is the importance of recognizing standards of testing?
- What could be a possible outcome if we did not have standards for inspection?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 11.9.1 Reasons For testing

- Define weld flaws and weld defects
- List criteria used in testing
- Determine the code that governs the standards being upheld
- Distinguish acceptable and rejectable defects

#### 11.9.2 Types of nondestructive tests

- List the major testing types
- Describe surface flaw and internal flaw
- Compare testing types with flaws they detect.
- Formulate a conclusion the importance of testing

#### 11.9.3 Performance of testing

- Determine what type of testing is to be performed
- Make a list of flaws you are looking for
- Gather equipment needed (fillet gauge, undercut gauge, measuring device, lighting)
- Perform a visual inspection on a T weld

**Technical Vocabulary-** defect, discontinuity, electromagnetic examination, flaw, magnetic particle testing, leak testing, penetrant examination, radiographic examination, ultrasonic examination, visual examination

**Resources-** Welding Fundamentals 6th Edition

## Priority Standard 11.10 - Welding Project/Production

### Big Idea:

- Apply advanced skills to the completion of shop projects.
- Welding projects are a great way to demonstrate proficiency in competencies learned throughout the year
- Welding projects are great for tying together both theory and hands on skills

### Essential Question(s):

- What is the importance of “workmanship”?
- What is the importance of learning advanced welding skills?
- What are characteristics of an acceptable finishing of a project?
- Does the technique change based on the materials used?
- How does the application of employability skills affect the success of a project?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 11.10.1 Construct Projects

- Measuring
- Layout
- Hand Tools
- Stationary Machines
- Common Weld Joints
- Project Completeness

- Proficiency will be determined by scoring a 3 or greater on individual project/production proficiency scales in the following areas:
  - Measuring
  - Layout
  - Hand Tools
  - Cutting
  - Common Weld Joints
  - Project Completion
- Demonstrate behavior expected for career employability

#### 11.10.2 Welding Portfolio

- Uploading evidence of proficiencies completing project to portfolio
- Update the Competency Checklist

**Technical Vocabulary-** workmanship, competency, portfolio, resume

**Resources-** Welding Fundamentals 6th Edition

## 12th Grade Curriculum

### Priority Standard 12.1 - Shop and Job Site Safety

**Big Idea (s):**

- Safety needs to be a habit and a consideration throughout daily living as well as in the work environment.
- Most shop injuries can be avoided if one is safety conscious.
- Each person is responsible for following safety procedures.

**Essential Question(s):**

- While working in the shop, what type of knowledge does a worker need to remain safe in the environment?
- Why is safety such an important concern inside shop environments?

#### Learning Outcomes

*Students will know:*

*As evidenced by: (oral, written, or performance)*

**12.1.1 Hazard Identification**

- Model safe practices
- Describe potential safety risks of:
  - Crush points
  - Pinch points
  - Burns
  - Eye injuries
  - Electrocution
  - Entanglements
  - Welding Fumes/Respiratory injuries
  - Lifting injuries
  - Compressed Gasses
- Demonstrate knowledge of proper personal protective equipment
- Prepare a list of safety rules for welding shop
- Proper storage of gas cylinders
- 100% on written safety test

<p><b>12.1.2 Safety Data Sheets</b></p>	<ul style="list-style-type: none"> <li>● Identify Safety Data Sheets layout and format</li> <li>● Locate the Safety Data Sheets in welding shop</li> <li>● 100% on written safety test</li> </ul>
<p><b>12.1.3 Fire Safety Procedures</b></p>	<ul style="list-style-type: none"> <li>● 100% on written safety test</li> <li>● Demonstrate proper 'hot zone' operation</li> <li>● Locate: <ul style="list-style-type: none"> <li>○ Fire alarms</li> <li>○ Fire extinguishers</li> <li>○ Eye wash stations</li> <li>○ Power shut offs</li> <li>○ Fire exits</li> </ul> </li> </ul>
<p><b>12.1.4 Personal Protective Equipment</b></p>	<ul style="list-style-type: none"> <li>● 100% on safety test</li> <li>● Wear appropriate safety clothing and equipment: <ul style="list-style-type: none"> <li>○ Eye Protection</li> <li>○ Welding Helmet</li> <li>○ Jacket</li> <li>○ Gloves</li> <li>○ Safety Shoes</li> </ul> </li> <li>● Select proper lens shade for specific welding and cutting operations</li> <li>● Describe dangers of arc flash and damage ultraviolet rays can do to the eyes</li> </ul>
<p><b>Technical Vocabulary-</b> arc flash, combustibles, hazardous, hot work, OSHA, PPE, SDS, cut off wheel, hard disc, flap disc</p>	
<p><b>Resources-</b> Welding Fundamentals: Chapter 2 - Safety in the Welding Shop (pg. 19-34)</p>	

## Priority Standard 12.2 - Welding Tools and Equipment

### Big Idea (s):

- It is essential to know how to select, safely use, and maintain the proper power tool for completion of the task at hand.
- Using hand tools can be just as dangerous as power tools.
- Using the appropriate tool can increase the quality of work.

### Essential Question (s):

- Why should you use the right tool for the job?
- What are possible repercussions of using the wrong tool for a job and using a tool incorrectly?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>12.2.1 Hand Tool Identification</b>	<ul style="list-style-type: none"> <li>● <b>Identify common welding shop hand tools and describe their purpose or function:</b> <ul style="list-style-type: none"> <li>○ Wrenches</li> <li>○ Saws</li> <li>○ Files</li> <li>○ Hand taps/dies (threading)</li> <li>○ Hammers</li> <li>○ Clamps</li> <li>○ Vises</li> <li>○ Pliers</li> <li>○ Screwdrivers</li> </ul> </li> </ul>
<b>12.2.2 Hand Tool Use</b>	<ul style="list-style-type: none"> <li>● <b>Select the appropriate hand tool for a specific application</b></li> <li>● <b>Demonstrate the proper safe use and care of each hand tool during a performance assessment</b></li> </ul>
<b>12.2.3 Power Tool Identification</b>	<ul style="list-style-type: none"> <li>● <b>Identify common shop power tools and describe their purpose or function:</b> <ul style="list-style-type: none"> <li>○ Drills</li> <li>○ Saws</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Grinders/Sanders</li> <li>○ Metal Forming tools</li> </ul>
<b>12.2.4 Power Tool Use</b>	<ul style="list-style-type: none"> <li>● Select the appropriate power tool for a specific application</li> <li>● Demonstrate the proper safe use and care of each power tool during a performance assessment</li> </ul>
<b>12.2.5 Angle Grinders</b>	<ul style="list-style-type: none"> <li>● Demonstrate ability to change wheels on an angle grinder safely</li> <li>● Demonstrate proper use of an angle grinder</li> <li>● Utilize proper angle grinder maintenance</li> <li>● Use grinder properly for weld preparation and to remove mill scale</li> <li>● Make a cut safely with a cut off wheel</li> <li>● Remove a weld properly using hard discs and flap discs</li> </ul>
<b>12.2.6 Welding Equipment</b>	<ul style="list-style-type: none"> <li>● Identify common shop Equipment and describe their purpose or function: <ul style="list-style-type: none"> <li>○ Drill Press</li> <li>○ Bandsaws</li> <li>○ Grinders/Sanders</li> <li>○ Benders</li> <li>○ Ironworkers</li> <li>○ Shears</li> <li>○ Lifting and moving</li> </ul> </li> </ul>
<p><b>Technical Vocabulary-</b> Clamps, Welpers, Level, Hammer, Square, Punch, Wire Brush, Chisel, Measuring device, Soapstone, Abrasive, Arbor, Arbor hole, Chatter, Cut off wheel, Disc Grinder, Dressers, Finish, Grinding Wheel, Guards, R.P.M, Wheel speed, Work Surface</p>	
<p><b>Resources-</b> Welding Fundamentals</p>	

## Priority Standard 12.3 - Blueprint Reading and Welding Math

### Big Idea (s):

- The ability to read and interpret drawings and welding symbols is critical to a welder's success.
- Blueprint reading gives the fabricator the essential information to create a weldment according to specifications.

### Essential Question (s):

- How do we look at the overall blueprint drawing to interpret its meaning?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
12.3.1 Views and isometric drawings	<ul style="list-style-type: none"> <li>● List the names of the views used in orthographic projection</li> <li>● Describe characteristics of an isometric drawing</li> </ul>
12.3.2 The ANSI-AWS welding symbols	<ul style="list-style-type: none"> <li>● Identify basic types of welds indicated on the ANSI/AWS weld symbol</li> <li>● Know arrow side and other side</li> </ul>
12.3.3 Weld sizes and other information	<ul style="list-style-type: none"> <li>● Locate information on the weld symbol to determine:                             <ul style="list-style-type: none"> <li>○ Size of root opening</li> <li>○ The groove angle</li> <li>○ Desired size</li> <li>○ Contour</li> <li>○ Finish of the weld</li> </ul> </li> </ul>
12.3.4 Measuring	<ul style="list-style-type: none"> <li>● Adding Measurements(fractions)</li> <li>● Subtracting fractions(fractions)</li> <li>● Calculate material length</li> <li>● Calculate area of shapes</li> <li>● Find center(Division)</li> <li>● Check accuracy of wire feeder</li> </ul>
12.3.5 Layout	<ul style="list-style-type: none"> <li>● Demonstrate proper layout of shop projects</li> <li>● Analyze layout for errors</li> </ul>

**Technical Vocabulary-** Square, Fractions, Align, Scale, Area, Dimension, Pythagorean Theorem, Right angle Triangle

**Resources-** Welding Fundamentals

## Priority Standard 12.4 - Shielded Metal Arc Welding (SMAW) Advance

### Big Idea(s):

- Shielded Metal Arc Welding Can be used in multiple positions.
- Shielded Metal Arc can be a useful process in hard to get to places.

### Essential Question(s):

- To what extent do angles affect a groove weld?
- What is the value of using SMAW over GMAW for groove welds?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>12.4.1 Equipment and Accessories</b>	<ul style="list-style-type: none"> <li>● Perform safety inspections of SMAW equipment and accessories</li> <li>● Perform minor external repairs to SMAW equipment and accessories</li> </ul>
<b>12.4.2 PPE and Hazard Identification</b>	<ul style="list-style-type: none"> <li>● Identify all of the parts of an arc welding outfit and its functions</li> <li>● Describe potential electrical hazards</li> <li>● 100% on written safety test</li> </ul>
<b>12.4.3 Current and Polarity Settings</b>	<ul style="list-style-type: none"> <li>● Identify polarities and how they work within a welding circuit, shown with both a written and hands on assessment</li> </ul>
<b>12.4.4 Safety Inspections of equipment, PPE, and Work Area</b>	<ul style="list-style-type: none"> <li>● Perform safety inspections of SMAW equipment and accessories</li> <li>● Makes minor external repairs to SMAW equipment and accessories</li> </ul>
<b>12.4.5 Principles of SMAW</b>	<ul style="list-style-type: none"> <li>● Sets up for SMAW operations on carbon steel</li> <li>● Operates SMAW equipment on carbon steel</li> <li>● Makes fillet weld in all positions on carbon steel</li> <li>● Makes groove welds, in all positions, on</li> </ul>

	<p><b>carbon steel</b></p> <ul style="list-style-type: none"> <li>• Passes SMAW welder performance qualification test</li> </ul>
<b>12.4.6 Safety for out of position welding</b>	<ul style="list-style-type: none"> <li>• Recall the basic PPE from flat SMAW welding</li> <li>• Contrast the need for added PPE in out of position welding vs flat welding</li> <li>• Evaluate PPE for damage</li> <li>• Wear PPE correctly</li> </ul>
<b>12.4.7 Groove Weld Positions</b>	<ul style="list-style-type: none"> <li>• List the four basic groove weld positions</li> <li>• Explain work angle and travel angle</li> <li>• Construct a list of angles for each position</li> </ul>
<b>12.4.8 Groove Joints</b>	<ul style="list-style-type: none"> <li>• List the different types of groove joint configurations</li> <li>• Discuss bead planning patterns</li> <li>• Compare concave and convex welds</li> <li>• Discuss the defects that occur for out of position welding</li> </ul>
<b>12.4.9 Groove Weld Performance qualification</b>	<ul style="list-style-type: none"> <li>• Identify material needed for testing</li> <li>• Interpret the requirements of testing procedure(Amperage,wire feed, preheat)</li> <li>• Prepare carbon steel for welding</li> <li>• Weld a 1G/2G/3G/4G to requirements to AWS standards</li> </ul>
<p><b>Technical Vocab-</b> Uphill welding, down hill welding, groove angle, bevel angle, root penetration, root opening, land, face, maximum reinforcement, horizontal, vertical, overhead, root bead, intermediate bead, finish bead, arc blow, arc length, chipping, drag angle, keyhole, porosity, restarts, root pass, inclusions, splatter, travel angle, electrode</p>	
<p><b>Resources:</b> Welding Fundamentals</p>	

## Priority Standard 12.5 - Gas Metal Arc Welding (GMAW) Advanced

### Big Idea(s):

- Gas Metal Arc Welding/Flux Cored Arc Welding are welding processes that are used to increase production and lower costs

### Essential Question(s):

- When is the best time to use GMAW over other welding processes?
- What is the appropriate operation to run G.M.A.W. safely?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>12.5.1 Equipment and Accessories Used in GMAW</b>	<ul style="list-style-type: none"> <li>• Perform safety inspections of GMAW equipment and accessories</li> <li>• Make minor external repairs to GMAW equipment and accessories</li> </ul>
<b>12.5.2 Components of an arc welding outfit and potential hazards</b>	<ul style="list-style-type: none"> <li>• Identify all of the parts of an arc welding outfit and its functions</li> <li>• Describe potential electrical hazards</li> <li>• 100% on written safety test</li> </ul>
<b>12.5.3 Voltage and Wire Speed Settings</b>	<ul style="list-style-type: none"> <li>• Describe voltage and wire speed settings</li> <li>• Proper set up of a GMAW machine relative to the material being welded</li> <li>• Demonstration of knowledge with both a written and hands on assessment</li> </ul>
<b>12.5.4 Safety Inspections of equipment, PPE, and Work Area</b>	<ul style="list-style-type: none"> <li>• Perform safety inspections of GMAW equipment and accessories</li> <li>• Make minor external repairs to GMAW equipment and accessories</li> </ul>
<b>12.5.5 Principles of GMAW</b>	<ul style="list-style-type: none"> <li>• Set up for GMAW operations on carbon steel</li> <li>• Operate GMAW equipment on carbon steel</li> </ul>

	<ul style="list-style-type: none"> <li>• Make fillet weld in all positions on carbon steel</li> <li>• Make groove welds, in all positions, on carbon steel</li> <li>• Pass AWS GMAW Welder Qualification Tests in the 2F/1G/2G/3G/4G positions</li> </ul>
12.5.6 P.P.E. and safety for out of position welding	<ul style="list-style-type: none"> <li>• Recall the basic PPE from flat SMAW welding</li> <li>• Contrast the need for added PPE in out of position welding vs flat welding</li> <li>• Evaluate PPE for damage</li> <li>• Wear PPE correctly</li> </ul>
12.5.7 Groove welds	<ul style="list-style-type: none"> <li>• List the four basic groove weld positions</li> <li>• Explain work angle and travel angle</li> <li>• Construct a list of angles for each position</li> <li>• List the different types of groove joint configurations</li> <li>• Discuss bead planning patterns</li> <li>• Compare concave and convex welds</li> <li>• Discuss the defects that occur for out of position welding</li> <li>• Identify material needed for testing</li> <li>• Interpret the requirements of testing procedure (Amperage, wire feed, preheat)</li> <li>• Prepare carbon steel for welding</li> <li>• Successfully weld a 1G/2G/3G/4G to requirements to AWS standards</li> </ul>
<p><b>Technical Vocab-</b> Uphill welding, downhill welding, groove angle, bevel angle, root penetration, root opening, land, face, maximum reinforcement, horizontal, vertical, overhead, root bead, intermediate bead, finish bead, arc blow, arc length, chipping, drag angle, keyhole, porosity, restarts, root pass, inclusions, splatter, travel angle, electrode</p>	
<p><b>Resources-</b> Welding Fundamentals</p>	

## Priority Standard 12.6 - Gas Tungsten Arc Welding (GTAW) Advanced

### Big Idea (s):

- Gas Tungsten Arc Welding is a welding process in which an arc is stuck between a tungsten electrode and the base metal.
- The tungsten electrode does not melt or become part of the weld. An inert gas shields the arc area from the atmosphere.

### Essential Question (s):

- How is GTAW beneficial when welding aluminum and other metals?
- Why is GTAW used to precision and thin weldments?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
12.6.1 Equipment and Supplies	<ul style="list-style-type: none"> <li>● Perform safety inspections of GTAW equipment and accessories</li> <li>● Make minor external repairs GTAW equipment and accessories</li> </ul>
12.6.2 Principles of GTAW	<ul style="list-style-type: none"> <li>● Set up for GTAW operations on carbon steel</li> <li>● Operate GTAW equipment on carbon steel</li> <li>● Make fillet weld in all positions on carbon steel</li> <li>● Make groove welds, in all positions, on carbon steel</li> <li>● Pass GTAW welder performance qualification test</li> </ul>
12.6.3 Parts of a GTAW torch	<ul style="list-style-type: none"> <li>● Identify the parts of a GTAW torch</li> <li>● Operate assembly and break down of a GTAW torch</li> </ul>
12.6.4 Safety Inspections and Precautions	<ul style="list-style-type: none"> <li>● Identify visible issues with GTAW machinery</li> <li>● Make minor repairs to GTAW equipment and accessories</li> </ul>
12.6.5 Use of GTAW Equipment	<ul style="list-style-type: none"> <li>● List all PPE required while using this process</li> <li>● Sharpens Tungsten properly</li> <li>● Uses correct collet for tungsten</li> </ul>

	<ul style="list-style-type: none"> <li>● <b>Set Gas to the appropriate setting</b></li> <li>● <b>determines appropriate amperage needed for specific task</b></li> <li>● <b>Perform a successful bead without the use of wire maintaining a consistent weld bead</b></li> <li>● <b>Produces welds with proper toe to crown weld placement</b></li> </ul>
<p><b>12.6.6 Performance Qualification</b></p>	<ul style="list-style-type: none"> <li>● <b>Identify material needed for testing</b></li> <li>● <b>Prepare carbon steel for welding</b></li> <li>● <b>Produce welds with proper bead size, appearance and weld placement before testing</b></li> <li>● <b>Perform GTAW fillet welds in the 1F and 2F positions according to AWS standards</b></li> </ul>
<p><b>Technical Vocabulary-</b> ceria, thoria, zirconia, collet, gas lens, heliarc, pre flow, post flow, pulsed current</p>	
<p><b>Resources-</b> Welding Fundamentals</p>	

**Priority Standard 12.7 - Cutting (PAC & OFC) Advanced Procedures**

**Big Idea (s):**

- Plasma Arc Cutting is a cutting process that can be used to cut any metal quickly and cleanly.
- Proper oxy-fuel set up is essential to maintaining a safe work environment.
- Oxy-fuel equipment is used for cutting and heating metal and used in many aspects of the welding industry.
- Each person is responsible for following safety procedures

**Essential Question (s):**

- When is the best time to use Plasma Arc Cutting over other cutting processes?
- What safety requirements are needed to operate a Plasma Arc Cutter?
- What are the advantages and disadvantages of oxy-fuel cutting?
- Why is safety such an important concern in regard to oxy-fuel equipment?

**Learning Outcomes**

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>12.7.1 PAC Safety Precautions</b>	<ul style="list-style-type: none"> <li>● Demonstrate proper setup of PAC equipment</li> <li>● Identify proper PPE used with PAC</li> <li>● Describe potential electrical hazards with PAC</li> </ul>
<b>12.7.2 PAC Equipment Set-Up</b>	<ul style="list-style-type: none"> <li>● Demonstrate proper setup of PAC equipment</li> </ul>
<b>12.7.3 PAC Process</b>	<ul style="list-style-type: none"> <li>● Demonstrate safe and proper cutting techniques</li> <li>● Perform 90 degree cut and restart cut in mild steel</li> <li>● Make a bevel cut on mild steel</li> <li>● Layout pattern and cut to specifications</li> </ul>
<b>12.7.4 OFC equipment and supplies</b>	<ul style="list-style-type: none"> <li>● Identify the parts of a OFC setup</li> <li>● Replace consumables on a OFC torch</li> </ul>
<b>12.7.5 Cutting</b>	<ul style="list-style-type: none"> <li>● Demonstrate safe and proper cutting techniques</li> <li>● Perform 90 degree cut and restart cut in mild steel</li> <li>● Make a bevel cut on mild steel</li> </ul>

	<ul style="list-style-type: none"><li>• <b>Layout pattern and cut to specifications</b></li></ul>
<b>Technical Vocabulary-</b> PAC: constricting nozzle, dross, plasma, swirl ring, gouging, kerf, heat shield OFC: acetylene, oxygen, flashback, infrared rays, orifice, preheat, regulator, working pressure	
<b>Resources-</b> Welding Fundamentals	

## Priority Standard 12.8 - Pipe and Tube Welding Advanced

### Big Idea(s):

- Pipe and Tube is used in almost every aspect of metalworking and fabricating. Welding it properly and safely is an essential skill for the welder.

### Essential Question(s):

- What determines the process and technique used to weld pipe and tube?
- How does the welding position affect the way the pipe is welded?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
12.8.1 Material Classification	<ul style="list-style-type: none"> <li>● Identify the differences between pipes and tubes during a performance assessment</li> <li>● Identify sizes and classification of pipe and tubular metals</li> </ul>
12.8.2 Pipe Welding Positions	<ul style="list-style-type: none"> <li>● Identify the positions for both groove and fillet welds on a written assessment</li> <li>● Explain the different groove positions for pipe welding</li> </ul>
12.8.3 Pipe Welding Techniques <ul style="list-style-type: none"> <li>● Uphill</li> <li>● Downhill</li> </ul>	<ul style="list-style-type: none"> <li>● Demonstrate the technique used for uphill and downhill welding on a practical assessment</li> </ul>
12.8.4 SMAW Pipe Welding	<ul style="list-style-type: none"> <li>● Weld an open root pipe joint using 6010 electrodes in the 2g position</li> <li>● Weld a closed root pipe joint using 7018 electrodes in the 2g position</li> <li>● Weld filler passes and cover pass using 7018 in the 5g position</li> </ul>
12.8.5 GTAW Pipe Welding	<ul style="list-style-type: none"> <li>● Weld an open root pipe joint using the GTAW process in the 1g rotated position</li> </ul>

	<ul style="list-style-type: none"> <li>● Weld an open root pipe joint using the GTAW process in the 2g position</li> <li>● Weld an open root pipe joint using the GTAW process in the 5g position</li> </ul>
<p><b>12.8.6 GMAW Pipe Welding</b></p>	<ul style="list-style-type: none"> <li>● Weld an open root pipe joint using the GMAW process in the 1G and 2G position</li> <li>● Weld an open root pipe joint using the GMAW process in the 5G and 6G position</li> </ul>
<p><b>Technical Vocabulary:</b> open root, groove angle, penetration, filler pass, hot pass, cover pass, backing ring</p>	
<p><b>Resources-</b> Welding Fundamentals</p>	

## Priority Standard 12.9 - Welder Certification Gas Metal Arc Welding

### Big Idea(s):

- Welder Certification is something a welder must do to secure and maintain work.
- The requirements of certification will help a welder pass tests for future employment.

### Essential Question(s):

- What is the importance of being able to successfully pass a certification test?
- To what extent does certification determine the quality of a weld and a welder?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>12.9.1 Importance of Passing Welder Certification</b>	<ul style="list-style-type: none"> <li>● Define what welder certification is</li> <li>● Explain how certification is important to welding</li> <li>● Demonstrate knowledge of the certification process</li> <li>● Develop a list of skills needed to successfully pass certification</li> </ul>
<b>12.9.2 Advanced Welding Procedures</b>	<ul style="list-style-type: none"> <li>● Recall the steps from 10.9.1</li> <li>● Gather temp sticks for preheat and interpass</li> <li>● Set up machine in accordance with the welding procedure</li> <li>● Calculate Joules formula</li> </ul>
<b>12.9.3 Performance needed to pass a certification</b>	<ul style="list-style-type: none"> <li>● Have a prior successful performance of 10.5 Gas Metal arc Fillet Welds</li> <li>● Have a prior successful performance 11.4 Gas Metal arc Groove Welds</li> </ul>
<b>12.9.4 Perform a certification in the 3G position</b>	<ul style="list-style-type: none"> <li>● Knowledge of the 3G position</li> <li>● Prepare steel for qualification test</li> <li>● Fitup test to testing tolerances</li> <li>● Perform welding in accordance to procedure</li> <li>● Successfully pass 3G qualification bend</li> </ul>

	test
<b>12.9.5 Common Destructive testing Methods</b>	<ul style="list-style-type: none"> <li>• List methods of destructive testing</li> <li>• Define vocabulary used in destructive testing</li> <li>• Compare the types of destructive testing methods</li> </ul>
<b>12.9.6 Prepare a guided bend test for destructive testing.</b>	<ul style="list-style-type: none"> <li>• Recall the procedure of 9.4 Introduction to Abrasive Equipment</li> <li>• Demonstrate proper PPE and hot work requirements</li> <li>• Layout specimens for a guided bend test</li> <li>• Cut pieces per layout on the bandsaw</li> </ul>
<b>12.9.7 Perform a guided bend test</b>	<ul style="list-style-type: none"> <li>• Identify face a root pieces</li> <li>• Perform a bend test</li> <li>• Perform a final visual examination</li> </ul>
<b>12.9.8 Reasons For testing</b>	<ul style="list-style-type: none"> <li>• Define weld flaws and weld defects</li> <li>• List criteria used in testing</li> <li>• Determine the code that governs the standards being upheld</li> <li>• Distinguish acceptable and rejectable defects</li> </ul>
<b>12.9.9 Types of nondestructive tests</b>	<ul style="list-style-type: none"> <li>• List the major testing types</li> <li>• Describe surface flaw and internal flaw</li> <li>• Compare testing types with flaws they detect.</li> <li>• Formulate a conclusion the importance of testing</li> </ul>
<b>12.9.10 Performance of testing</b>	<ul style="list-style-type: none"> <li>• Determine what type of testing is to be performed</li> <li>• Make a list of flaws you are looking for</li> <li>• Gather equipment needed (fillet gauge, undercut gauge, measuring device, lighting)</li> <li>• Perform a visual inspection on a T weld</li> </ul>

**Technical Vocabulary-** Defect, discontinuity, electromagnetic examination, flaw, magnetic particle testing, leak testing, penetrant examination, radiographic examination, ultrasonic examination, visual

examination, Base Metal, certification, Root Opening, Groove, Technique, Filler Metal, WPS, Polarity, Voltage, Amperage Electrode, Preheat, Inter-pass

**Resources-** Welding Fundamentals

## Priority Standard 12.10 - Introduction to Gas Metal Arc Welding Spray

### Big Idea(s):

- Gas Metal Arc Spray welding is used for heavier steels and high production work
- Gas Metal Arc Spray welding is limited in its capabilities for out of position welding.

### Essential Question(s):

- To what extent does Gas Metal Arc Spray Welding benefit production work?

### Learning Outcomes

<i>Students will know:</i>	<i>As evidenced by: (oral, written, or performance)</i>
<b>12.10.1 Principles of Gas Metal Arc Welding Spray</b>	<ul style="list-style-type: none"> <li>● Define Gas Metal Arc Welding</li> <li>● Identify the main differences from other processes</li> <li>● Describe when it is appropriate to use Gas Metal Arc Spray Welding</li> <li>● Select the two positions Spray welding can be performed in</li> </ul>
<b>12.10.2 Equipment setup</b>	<ul style="list-style-type: none"> <li>● Lists all parts associated with Gas Metal Arc Spray Welding</li> <li>● Performs safety inspection of all equipment and accessories</li> <li>● Makes minor repairs if needed or tells the instructor of deficient conditions</li> <li>● Performs a safety ground check</li> </ul>
<b>12.10.3 Equipment use</b>	<ul style="list-style-type: none"> <li>● Identifies appropriate PPE required in this process</li> <li>● Identifies the hot work boundaries</li> <li>● determines appropriate amperage needed for specific task</li> <li>● Runs a bead in the Flat position while maintaining arc distance and travel speed</li> </ul>
<b>12.10.4 Performance qualification</b>	<ul style="list-style-type: none"> <li>● Identifies material needed for testing</li> <li>● Interpret the requirements of testing procedure(Amperage,wire feed, preheat)</li> </ul>

	<ul style="list-style-type: none"><li>• Prepares carbon steel for welding</li><li>• Can successfully produce proper toe to crown placement before testing.</li></ul>
<b>Technical vocab</b> - argon, carbon dioxide, consumable electrode, contact tube, drive rollers, Flow meter, gas nozzle, liner, welding gun, wire feeder	
<b>Resources-</b> Welding Fundamentals	

## Priority Standard 12.11 - Welding Project/Production

### Big Idea:

- Apply advanced skills to the completion of shop projects.
- Welding projects are a great way to demonstrate proficiency in competencies learned throughout the year
- Welding projects are great for tying together both theory and hands on skills

### Essential Question(s):

- What is the importance of “workmanship”?
- What is the importance of learning advanced welding skills?
- What are characteristics of an acceptable finishing of a project?
- Does the technique change based on the materials used?
- How does the application of employability skills affect the success of a project?

### Learning Outcomes

#### *Students will know:*

#### *As evidenced by: (oral, written, or performance)*

#### 12.11.1 Construct Projects

- Measuring
- Layout
- Hand Tools
- Stationary Machines
- Common Weld Joints
- Project Completeness

- Proficiency will be determined by scoring a 3 or greater on individual project/production proficiency scales in the following areas:
  - Measuring
  - Layout
  - Hand Tools
  - Cutting
  - Common Weld Joints
  - Project Completion
- Demonstrate behavior expected for career employability

#### 12.11.2 Welding Portfolio

- Uploading evidence of proficiencies completing project to portfolio
- Update the Competency Checklist

**Technical Vocabulary-** workmanship, competency, portfolio, resume

**Resources-** Welding Fundamentals 6th Edition