

**West Sound Technical Skills Center
101 National Avenue N. Bremerton WA 98312**

Instructor: Bela Kovacs

Email: bela.kovacs@westsoundtech.org

Telephone: 360-473-0581

Hours: 7:30 a.m. – 3:00 p.m.

Session 1 8:00 AM – 10:30 AM

Session 2 11:10 AM – 1:40 PM

Welding Trades Course Syllabus – updated June 2019

PROGRAM DESCRIPTION

The Welding Trades Program at West Sound Technical Skills Center) will introduce local high school students to the world of welding.. The students will experience hands on training with the tools of the trade in a real world setting. This program includes both in-class theory and on the job site experience. The Welding program is housed in a large facility that includes an expansive shop and classroom area. The program has a large outside work area where the students apply their skills.

Students learn to cut and join metal using gas torch, arc and wire-feed welding equipment; repair broken metal parts on machinery, equipment, boats and structures. Students can be prepared to meet industry certification requirements as a certified welder upon successful completion of the program. Students will learn: shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW), gas metal arc welding (GMAW), flux-core arc welding FCAW), air carbon arc cutting, plasma arc cutting, and oxy-fuel gas cutting and welding.

Students will be required to read and comprehend professional technical manuals; perform required business math skills; and communicate effectively in written and oral presentations. Dexterity and spatial skills contribute to student's individual success in this career field. A strong command of math skills to include addition/subtraction/multiplication/division of whole numbers and fractions, measurement principles, plus an understanding of geometry will be necessary in this program. Students should possess good manual dexterity, have the ability to work on feet for long period of time and be able to lift heavy objects. Students need to complete at least one year for minimum skill development.

This program is modified open entry, which means a student may start at several time during the school year, depending on space available in the class. Students can receive elective and specific credits recommended to sending schools dependent upon student's length of enrollment. Students that successfully complete the course will receive a certificate and have the opportunity to move into apprenticeship positions .**Students can also earn 16 credits from Olympic College, 10 credits from Bates or 13 credits from Clover Park.** Certification from Washington Association of Building Officials (WABO) available upon passing test to weld structural steel. WABO test is available at Olympic College for a fee.

CAREER OPTIONS:

- Shipyard worker
- Aluminum Welder
- Body and Fender Repairers
- Carpenter Welder

- Sheet metal Worker
- Welding Inspectors
- Welding Technician

STUDENT-PROGRAM OUTCOMES

Upon successful completion of the Welding Program, the student should be able to:

1. Basic Safety

Explain the safety obligations of workers, supervisors, and managers to ensure a safe workplace. Discuss the causes and results of accidents, and the dangers of rationalizing risk. Review the role of company policies and OSHA regulations in maintaining a safe workplace. Introduce common job-site hazards and protections such as lockout/tagout, personal protective equipment (PPE), and HazCom.

1. Explain the role that safety plays in the construction crafts.
2. Describe the meaning of job-site safety.
3. Describe the characteristics of a competent person and a qualified person.
4. Explain the appropriate safety precautions to use around common job-site hazards.
5. Demonstrate the use and care of appropriate personal protective equipment (PPE).
6. Properly don and remove personal protective equipment (safety goggles, hard hat, and personal fall protection).
7. Follow the safety procedures required for lifting heavy objects.
8. Describe safe behavior on and around ladders and scaffolds.
9. Explain the importance of Hazard Communications (HazCom) and material safety data sheets (MSDSs).
10. Describe fire prevention and firefighting techniques.
11. Define safe work procedures to use around electrical hazards.

2 Welding Safety

Identify the appropriate use of safety equipment, protective clothing, and procedures applicable to the cutting and welding of metals.

1. Identify some common hazards in welding.
2. Explain and identify proper personal protection used in welding.
3. Demonstrate how to avoid welding fumes.
4. Explain some of the causes of accidents.
5. Identify and explain uses for material safety data sheets.
6. Demonstrate safety techniques for storing and handling cylinders.
7. Explain how to avoid electric shock when welding.
8. Demonstrate proper material handling methods.

3 Introduction to Construction Math

Review basic mathematical functions such as adding, subtracting, dividing, and multiplying whole numbers, fractions, and decimals, and explains their applications to the construction trades. Explain decimal-fraction conversions and the metric system using practical examples. Also reviews basic geometry as applied to common shapes and forms.

1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2. Use a standard ruler and a metric ruler to measure.
3. Add, subtract, multiply, and divide fractions.

4. Add, subtract, multiply, and divide decimals, with and without a calculator.
5. Convert decimals to percentages and percentages to decimals.
6. Convert fractions to decimals and decimals to fractions.
7. Explain what the metric system is and how it is important in the construction trade.
8. Recognize and use metric units of length, weight, volume, and temperature.
9. Recognize some of the basic shapes used in the construction industry, and apply basic geometry to measure them.

4 Oxyfuel Cutting

Explain the safety requirements for oxyfuel cutting. Identifies oxyfuel cutting equipment and setup requirements. Explain how to light, adjust, and shut down oxyfuel equipment. Trainee will perform cutting techniques that include straight line, piercing, bevels, washing, and gouging.

1. Identify and explain the use of oxyfuel cutting equipment.
2. Set up oxyfuel equipment.
3. Light and adjust an oxyfuel torch.
4. Shut down oxyfuel cutting equipment.
5. Disassemble oxyfuel equipment.
6. Change empty cylinders.
7. Perform oxyfuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
 - Gouging
8. Operate a motorized, portable oxy-fuel gas cutting machine.

5 Introduction to Hand Tools

Introduce trainee to hand tools that are widely used in the construction industry, such as hammers, saws, levels, pullers, vises, and clamps. Student will explain the specific applications of each tool and shows how to use them properly and discuss important safety and maintenance issues related to hand tools.

1. Recognize and identify some of the basic hand tools used in the construction trade.
2. Use hand tools safely.
3. Describe the basic procedures for taking care of hand tools.

6 Introduction to Power Tools

Provides detailed descriptions of commonly used power tools such as drills, saws, grinders, and sanders. Reviews applications, proper use, safety, and maintenance. Many illustrations show power tools used in on-the-job settings.

1. Identify power tools commonly used in the construction trades.
2. Use power tools safely.
3. Explain how to maintain power tools properly

7 Base Metal Preparation

Describe how to clean and prepare all types of base metals for cutting or welding. Identifies and explains joint design and base metal preparation for all welding tasks.

1. Clean base metal for welding or cutting.
2. Identify and explain joint design.
3. Explain joint design considerations.
4. Using a nibbler, cutter, or grinder, mechanically prepare the edge of a mild steel plate 1/4" to 3/4" thick at 22 1/2° (or 30° depending on equipment available).
5. Using a nibbler, cutter, or grinder, mechanically prepare the end of a pipe with a 30° or 37 1/2° bevel (depending on equipment available) and a 3/32" land. Use 6", 8", or 10" Schedule 40 or Schedule 80 mild steel pipe.
6. Select the proper joint design based on a welding procedure specification (WPS) or instructor direction.

8 Weld Quality

Identifies the codes that govern welding. Identifies and explains weld imperfections and causes. Describe non-destructive examination practices, welder qualification tests, and the importance of quality workmanship.

1. Identify and explain codes governing welding.
2. Identify and explain weld imperfections and their causes.
3. Identify and explain nondestructive examination practices.
4. Identify and explain welder qualification tests.
5. Explain the importance of quality workmanship.
6. Identify common destructive testing methods.

9 Electrodes and Selection

Explain electrode characteristics and different types of filler metals. Describe the role of the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME). Explains proper storage and control of filler metals and identifies the use of codes.

1. Identify factors that affect electrode selection.
2. Explain the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME) filler metal classification system.
3. Identify different types of filler metals.
4. Explain the storage and control of filler metals.
5. Explain filler metal traceability requirements and how to use applicable code requirements.
6. Identify and select the proper electrode for an identified welding task.

10 Joint Fit-Up and Alignment

Identifies and explains job code specifications. Describes the use of fit-up gauges and measuring devices to check fit-up and alignment and the use of plate and pipe fit-up and alignment tools to properly prepare joints. Explains how to check for joint misalignment and poor fit.

1. Identify and explain job code specifications.
2. Use fit-up gauges and measuring devices to check joint fit-up.
3. Identify and explain distortion and how it is controlled.
4. Fit up joint using plate and pipe fit-up tools.
5. Check for joint misalignment and poor fit-up before and after welding.

11 SMAW – Equipment and Setup

Describes SMAW and welding safety. Explains how to connect welding current and set up arc welding equipment. Identifies and explains using tools for cleaning welds.

1. Identify and explain shielded metal arc welding (SMAW) safety.
2. Identify and explain welding electrical current.
3. Identify and explain arc welding machines.
4. Explain setting up arc welding equipment.
5. Set up a machine for welding.
6. Identify and explain tools for weld cleaning.

12 SMAW – Beads and Fillet Welds

Describes the preparation and setup of arc welding equipment and the process of striking an arc. Explains how to detect and correct arc blow. Describes how to make stringer, weave, overlapping beads, and fillet welds.

1. Set up shielded metal arc welding (SMAW) equipment.
2. Describe methods of striking an arc.
3. Properly strike and extinguish an arc.
4. Describe causes of arc blow and wander.
5. Make stringer, weave, and overlapping beads.
6. Make fillet welds in the:
 - Horizontal (2F) position
 - Vertical (3F) position
 - Overhead (4F) position

13 Groove Welds with Backing

Explains groove welds and how to set up welding equipment for making groove welds. Describes how to make groove welds with backing. Provides procedures for making flat, horizontal, vertical, and overhead groove welds.

1. Identify and explain groove welds.
2. Identify and explain groove welds with backing.
3. Set up shielded metal arc welding (SMAW) equipment for making V-groove welds.
4. Perform SMAW for V-groove welds with backing in the:
 - Flat (1G) position
 - Horizontal (2G) position
 - Vertical (3G) position
 - Overhead (4G) position

14 Open V-Groove Welds

Explains open V-groove welds and how to set up welding equipment for making open V-groove welds. Provide procedures for making flat, horizontal, vertical, and overhead open V-groove welds.

1. Prepare shielded metal arc welding (SMAW) equipment for open-root V-groove welds.

2. Perform open-root V-groove welds in the:

- Flat (1G) position
- Horizontal (2G) position
- Vertical (3G) position
- Overhead (4G) position

15 Plasma Arc Cutting and Gouging

Describe air carbon arc cutting equipment and processes. Identify the electrodes and safe operation of the equipment. Provide step-by-step instructions for performing air carbon arc washing and gouging activities.

1. Identify and explain the plasma arc cutting (PAC) process and equipment.
2. Select and install PAC electrodes.
3. Prepare the work area and PAC equipment for safe operation.
4. Use PAC equipment for washing and gouging activities.
5. Perform storage and housekeeping activities for PAC-equipment.
6. Make minor repairs to PAC- equipment.

16 Introduction to Blueprints

Familiarizes trainees with basic blueprint terms, components, and symbols. Explains the different types of blueprint drawings (civil, architectural, structural, mechanical, plumbing/piping, and electrical) and instructs trainees on how to interpret and use drawing dimensions.

1. Recognize and identify basic blueprint terms, components, and symbols.
2. Relate information on blueprints to actual locations on the print.
3. Recognize different classifications of drawings.
4. Interpret and use drawing dimensions.

17 Reading Welding Detail Drawings

Identifies and explains welding detail drawings. Describes lines, fills, object views, and dimensioning on drawings. Explains how to use notes on drawings and the bill of materials.

1. Identify and explain a welding detail drawing.
2. Identify and explain lines, material fills, and sections.
3. Identify and explain object views.
4. Identify and explain dimensioning.
5. Identify and explain notes and bill of materials.
6. Interpret basic elements of a welding detail drawing.
7. Develop basic welding drawings.

18. Welding Symbols

Identifies and explains the different parts of a welding symbol. Describe different types of fillet weld, groove weld, and non-destructive examination symbols. Explain how to read welding symbols on drawings, specifications, and welding procedure specifications.

1. Identify and explain the various parts of a welding symbol.
2. Identify and explain fillet and groove weld symbols.
3. Read welding symbols on drawings, specifications, and welding procedure specifications.
4. Interpret welding symbols from a print.

5. Draw welding symbols based on the observation of actual welds.

19. Basic Communication Skills

Provides trainees with techniques for communicating effectively with co-workers and supervisors. Include practical examples that emphasize the importance of verbal and written information and instructions on the job.

1. Student will demonstrate effective telephone and e-mail communication skills.
2. Demonstrate the ability to interpret information and instructions presented in both written and verbal form.
3. Demonstrate the ability to communicate effectively in on-the-job situations using written and verbal skills.

20. Basic Employability Skills

Identifies the roles of individuals and companies in the construction industry. Introduce trainees to critical thinking and problem solving skills and computer systems and their industry applications. Also reviews effective relationship skills, effective self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.

1. Explain the construction industry, the role of the companies that make up the industry, and the role of individual professionals in the industry.
2. Demonstrate critical thinking skills and the ability to solve problems using those skills.
3. Demonstrate knowledge of computer systems, and explain common uses for computers in the construction industry.
4. Demonstrate effective relationship skills with teammates and supervisors, the ability to work on a team, and appropriate leadership skills.
5. Be aware of workplace issues such as sexual harassment, stress, and substance abuse.

21. Basic Rigging

Explain how ropes, chains, hoists, loaders, and cranes are used to move material and equipment from one location to another on a job site. Describe inspection techniques and load-handling safety practices. Also reviews American National Standards Institute (ANSI) hand signals.

1. Identify and describe the use of slings and common rigging hardware.
2. Describe basic inspection techniques and rejection criteria used for slings and hardware.
3. Describe basic hitch configurations and their proper connections.
4. Describe basic load-handling safety practices.
5. Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

22. Open-Root Pipe Welds

Explains open-root pipe welds and how to set up welding equipment for making open-root pipe welds. Provide procedures for making 1G, 2G, 5G, and 6G open-root pipe welds.

1. Prepare shielded metal arc welding (SMAW) equipment for open-root V-groove pipe welds.
2. Identify and explain open-root V-groove pipe welds.
3. Perform SMAW for open-root welds in the:

- Flat (1G-ROTATED) position
- Horizontal (2G) position
- Multiple (5G) position
- Multiple inclined (6G) position

23. Stainless Steel Groove and Pipe Welds

Explains stainless metallurgy and the selection of proper electrodes. Describe stainless steel groove welds and how to set up welding equipment for making stainless steel groove welds. Provide procedures for making flat, horizontal, vertical, and overhead stainless steel groove welds.

1. Identify and explain stainless steel metallurgy.
2. Identify and explain the selection of electrodes for welding stainless steel.
3. Identify and explain welding variations for stainless steel.
4. Prepare arc welding equipment for stainless steel welds.
5. Explain stainless steel open-root V-groove welds.
6. Perform shielded metal arc welding (SMAW) on stainless steel open-root V-groove joints in the following positions:
 - Flat (1G) position
 - Horizontal (2G) position
 - Vertical (3G) position
 - Overhead (4G) position
7. Explain stainless steel open-root V-groove pipe welds.
8. Perform shielded metal arc welding (SMAW) on stainless steel open-root V-groove pipe welds in the following positions:
 - Flat (1G-ROTATED) position
 - Horizontal (2G) position
 - Multiple (5G) position
 - Inclined multiple (6G) position

24. Plasma Arc Cutting (PAC)

Explains plasma arc cutting equipment and safe work area preparation. Identifies correct amperage, gas pressures, and flow rates. Cover plasma-arc cutting methods for piercing, slotting, squaring, and beveling metals. Explains how to store equipment and clean the work area.

1. Identify and understand plasma arc cutting processes.
2. Identify plasma arc cutting equipment.
3. Prepare and set up plasma arc cutting equipment.
4. Use plasma arc cutting equipment to make various types of cuts.
5. Properly store equipment and clean the work area after use.

25. GMAW and FCAW – Equipment and Filler Metals

Describes general safety procedures for GMAW and FCAW. Identifies GMAW and FCAW equipment and explains the filler metals and shielding gases used to perform GMAW and FCAW. Explains how to set up and use GMAW and FCAW equipment.

1. Explain gas metal arc welding (GMAW) and flux cored arc welding (FCAW) safety.
2. Explain the characteristics of welding current and power sources.

3. Identify and explain the use of GMAW and FCAW equipment:

- Spray transfer
- Globular
- Short circuiting
- Pulse

4. Identify and explain the use of GMAW and FCAW shielding gases and filler metals.

5. Set up GMAW and FCAW equipment and identify tools for weld cleaning.

26. GMAW and FCAW – Plate

Explains how to set up GMAW and FCAW equipment and build a pad of stringer beads and weave beads using filler metals and shielding gas. Explains procedures to perform GMAW multi-pass fillet welds on plate in various positions.

1. Perform GMAW multiple-pass fillet welds on plate, using solid or composite wire and shielding gas in multiple positions.
2. Perform GMAW multiple-pass open-root V-groove welds on plate, using solid or composite wire and shielding gas, in multiple positions.
3. Perform GMAW spray fillet and open-root V-groove welds on plate, using solid or composite wire and shielding gas, in flat and horizontal positions.
4. Perform FCAW multiple-pass fillet welds on plate in multiple positions using flux cored wire and, if required, shielding gas.
5. Perform FCAW multiple-pass open-root V-groove welds on plate in multiple positions using flux cored wire and, if required, shielding gas.

27. GTAW – Equipment and Filler Materials

Explains GTAW safety. Identifies and explains the use of GTAW equipment, filler metals, and shielding gases. Cover the setup of GTAW equipment.

1. Explain gas tungsten arc welding (GTAW) safety.
2. Identify and explain the use of GTAW equipment.
3. Identify and explain the use of GTAW filler metals.
4. Identify and explain the use of GTAW shielding gases.
5. Set up GTAW equipment.

28. GTAW – Plate

Describes how to pad in all positions using GTAW and carbon steel filler metal. Covers making multi-pass V-butt open-groove welds with carbon steel filler metal in the 1G, 2G, 3G, and 4G positions.

1. Build a pad in the flat position with stringer beads using GTAW and carbon steel filler metal.
2. Make multiple-pass open-root V-groove welds on carbon steel plate in the 1G (flat) position using GTAW and carbon steel filler metal.
3. Make multiple-pass open-root V-groove welds on carbon steel plate in the 2G (horizontal) position using GTAW and carbon steel filler metal.
4. Make multiple-pass open-root V-groove welds on carbon steel plate in the 3G (vertical) position using GTAW and carbon steel filler metal.
5. Make multiple-pass open-root V-groove welds on carbon steel plate in the 4G (overhead) position using GTAW and carbon steel filler metal.

29. GTAW – Aluminum Plate

Covers open root V-groove welding of aluminum pipe in the 2G, 5G, and 6G positions.

1. Identify and explain aluminum metallurgy.
2. Explain and identify characteristics of aluminum.
3. Explain GTAW and set up equipment to weld aluminum plate.
4. Explain and practice GTAW techniques for plate, including padding in the flat position with stringer beads, using aluminum filler metal.
5. Make fillet welds on aluminum plate in the following positions:
 - 1F (flat)
 - 2F (horizontal)
 - 3F (vertical)
 - 4F (overhead)
6. Make multiple-pass V-groove welds with backing on aluminum plate in the following positions:
 - 1G (flat)
 - 2G (horizontal)
 - 3G (vertical)
 - 4G (overhead)

30. Leadership Skills

Skills USA

TEXTBOOKS AND MATERIALS REQUIRED

- Welding Principles and Applications 7th edition Larry Jeffus (Replacement cost \$180.00)
- Notebook ,permanent markers, pencils, pens
- Gauntlet style welding gloves
- Leather boots (at least ankle high)

• **Suggested Items**

- 1)Welding Hood with shade 10-12 lens
- 2)Slag Hammer
- 3)Wire Cutters
- 4)Leather Welding Jacket or Coveralls to protect clothing
- The suggested items listed above are furnished by WSTSC and students are expected to return them in the same condition as received. Many students elect to furnish their own gear.
- The first pair of safety glasses are furnished by WSTSC and must be worn at all times in the shop area.

INSTRUCTIONAL STRATEGIES

Students will be given visual materials in the form of handouts. Visual aids such as projectors and white boards will be implemented to help with student understanding of lesson plan concepts. Objectives for daily lessons are written clearly on the board with daily questions and general concepts written and stated to the students each day to start class discussions. Instructor will state the learning targets and give multiple examples for students to draw information from.

Students will be asked to verbally relate what they've learned to their peers in a group discussion format. Students will be assigned written work and reading assignments that will reinforce the lesson plans. After thorough review the students will be given hands on assignments. Full scale individual projects and all class welding projects will bolster objectives. The students will be checked for learning by written exams. The instructor will demonstrate proper safety and the physical skills that students will need to learn. The instructor will then guide the students individually until the students have acquired acceptable industry proficiency. Students will be asked to perform skills individually for assessments. Every assessment will be geared to meet or exceed industry standards.

ASSESSMENT:

Students will be assessed in a competency based method that will track their ability to demonstrate manipulative skills, cognitive skills, and employability skills. Written assessments will be given periodically throughout the year. Exams will have multiple choice, true/false, and completion problems. Most exams include math problems that may require drawings, computations, and written explanations.

- Students will need to demonstrate pre-apprenticeship workman-like skills
- Students will need to translate verbal and written instructions to real work settings
- Students will be expected to show conscientious safe behaviors
- Students will need to demonstrate effective communication and leadership skills
- Students will need to compile a portfolio of all class assignments, projects, and handouts
- Students will be expected to complete a resume and cover letter
- Students will be required to achieve 80% proficiency on safety exams to use tools and equipment
- Students must gain 80% proficiency on all written exams to achieve Industry Qualifications (Referral)
- Students must achieve a 3 or better competency score to meet Pre-Apprenticeship standing and Industry Qualifications (Referral)

Competency Scoring (0 – 4)

4 = Highly-Skilled- Outstanding
3 = Skilled
2 = Semi-Skilled
1 = Minimally-Skilled
0 = No Skill or No Exposure

ASSESMENT STRATEGIES:

- Completion of assigned competencies.
- Unit tests and exams
- Daily grade average.

GRADING SCALE: letter grade Industry sets the performance standards for this course and proficiency levels.

Category Classifications: Percent of Grade

Class Work Daily participation in practice activities; classwork, bookwork 60%

Skills Proficiency Demonstration 30%

21st Century Skills 10%

ABSENCES

The West Sound Technical Skills Center Construction Trades program is professional preparatory in nature and follows an attendance policy similar to business and industry. The student is considered an employee or a professional and is expected to be in full daily attendance (2.5 hours) in order to assure that maximum learning and productivity are achieved.

This is a hands-on training program therefore, attendance and punctuality are critical. Absences will adversely affect a student's progress. Poor attendance, arriving late, and/or leaving early are all indications of poor work ethic and can lead to lowering of employability scores. Students have a very difficult time keeping up with the course work if they are not here. They also miss valuable practical experience in the lab activities. Absences may affect the student's ability to earn high school credit and/or affect whether the student continues in the training program.

You are required to call or e-mail your instructor if you are going to be absent or tardy for any reason.

BEHAVIOR EXPECTATIONS

This is a professional, preparatory program which can lead directly to apprenticeship, employment, or post-secondary placement. You are expected to demonstrate behaviors appropriate to those settings. Please refer to student handbook for detailed information.

NON-DISCRIMINATION DISCLOSURE

The Bremerton School District complies with all federal and state rules and regulations and does not discriminate on the basis of sex, race, creed, religion, color, national origin, age, honorably discharged veteran or military status, sexual orientation including gender expression or identity, the presence of any sensory, mental, or physical disability, or the use of a trained dog guide or service animal by a person with a disability in its programs and activities and provides equal access to the Boy Scouts and other designated youth groups. This holds true for all students who are interested in participation in educational programs and/or extra-curricular school activities. Inquiries regarding compliance and/or grievance procedures may be directed to the District's Title IX/RCW 28A.640 Officer and ADA Coordinator, Garth Steedman, at 360.473.1031, email garth.steedman@bremertonschools.org or the Section 504 Coordinator, John Welsh, at 360.473.4400, email john.welsh@bremertonschools.org. Mailing address: 134 Marion Avenue North, Bremerton, WA 98312.