

Utah State University Eastern
College of Agriculture and Applied Sciences (CAAS)
Department of Aviation, Technology and Education (AVTE)

Welding Technology

Assessment Plan
Revision: Fall 2021

Program Description:

USU Eastern's welding technology program offers unique opportunities for students interested in the field of welding to receive excellent instruction in hands-on welding skills, welding theory and scientific concepts, and to explore additional careers in the field of welding including inspection, engineering, and project management. In-depth instruction is provided in all common arc welding and cutting processes, such as: Gas Metal Arc Welding (GMAW), Flux-cored Arc Welding (FCAW), Gas Tungsten Arc Welding (GTAW), Shielded Metal Arc Welding (SMAW), Oxy-fuel Cutting (OFC), and Plasma Arc Cutting (PAC). Additional welding processes are explored and introduced including: Submerged-Arc Welding (SAW), Resistance Spot Welding (RSW), Stud Welding (SW), Brazing, Soldering, and Carbon Arc Cutting (CAC-A). Print reading, weld inspection, welding metallurgy, and structural fabrication courses are also offered.

Successful students may work as welders locally or nationally, manage welding/fabrication shops, start their own welding businesses, explore careers in weld inspection, or seek baccalaureate and/or graduate degrees after graduation with welding as a program area of study.

The program offers a Certificate of Completion, and an Associate of Applied Science- additionally, many students choose to complete an Associate of Science (in addition to a Welding AAS) in order to more seamlessly transfer to baccalaureate and graduate programs.

Mission:

The mission of Utah State University's Welding Technology Program is to inspire and prepare students for success in the field of welding by providing expert training and education, maximizing hands-on welding experience using state-of-the art equipment, and preparing students to weld and work in a variety of industrial settings, giving them the best opportunity for employment and advancement within the local, regional, and national industry.

Learning Objectives:

1. Demonstrated understanding of industrial welding safety
2. Demonstrated knowledge and hands-on welding skill in all major arc-welding processes: GMAW, FCAW, GTAW, and SMAW
3. Demonstrated knowledge and hands-on skill using PAC and OFC
4. Demonstrated proficiency in welding fabrication and layout
5. Ability to interpret blueprints and AWS welding symbols
6. Basic understanding of weld inspection theory and practice
7. Understanding of basic ferrous metallurgy concepts

Program Course Offerings:

- **WELD 1010 – Beginning Arc Welding** (3 credits; 2 lab, 1 theory)
Course Description: This course is designed for the general public and for students in USU-Eastern’s diesel mechanics program. It is an introductory course that emphasizes the practical and theoretical fundamentals of Shielded Metal Arc Welding (SMAW), Gas-Metal Arc Welding, Oxy-Fuel Cutting (OFC), and Plasma Arc Cutting (PAC). This course covers safety aspects associated with welding and common hazards found in a metal shop. Power sources (welding machines) and electricity are discussed in a welding context. Electrode filler metal selection and classification, common joint designs and welding positions are reviewed.
- **WELD 1100 – Beginning Shielded Metal Arc Welding (SMAW)** (5 credits; 3 lab, 2 theory)
Course Description: This is a beginning course designed for welding technology majors who plan on choosing a career in the welding industry and others whose job may contain a high degree of welding content. The course covers theory and hands-on practice to develop the necessary skills and knowledge to become a proficient welder using the SMAW process. Oxy-fuel cutting will be thoroughly reviewed and used in practice. Carbon arc cutting will be introduced. Familiarization with associated shop equipment will also be necessary to facilitate the primary objective of learning the SMAW process. This course will cover safety aspects associated with SMAW, oxy-fuel cutting and other common hazards that might be found in a metal shop. Common base metal designations, electrode selection and classification, joint design and preparation will be reviewed.
- **WELD 1110 – Advanced SMAW** (5 credits; 3 lab, 2 theory)
Course Description: This is an advanced course designed for welding technology majors and for people who are already in the industry working as welders. This course is intended to prepare students for employment and industry certification to welding codes such as: AWS D1.1, API 1104, and ASME Section IX. However, completion of this course alone does not ensure either employment or certification success. Course emphasis is on welding structural and pipe groove joints. The root of the open root joints will be welded with E6010 electrodes. Joints with backing strips are generally made with E7018 electrodes. Training will be performed in all common welding positions. Students will take an all position certification test simulating the test required by the AWS D1.1 Structural Welding Code book.

- WELD 1120 – Beginning Gas Metal Arc Welding and Flux-Cored Arc Welding (GMAW/FCAW)** (5 credits; 3 lab, 2 theory)

Course Description: This is an introductory course designed for welding technology majors who plan a career in the welding industry and others whose job may contain a high degree of welding content. The course covers theory and hands-on practice to develop the necessary skills and knowledge to become a proficient welder using the Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW) processes. Plasma Arc Cutting (PAC) is introduced. Familiarization with associated shop equipment is necessary to facilitate the primary learning objectives of these processes. This course covers safety aspects associated with welding and cutting and other common hazards that are found in a metal shop. Common base metal designations, electrode selection and classification, joint design and preparation are reviewed.
- WELD 1130 – Advanced GMAW/FCAW** (5 credits; 3 lab, 2 theory)

Course Description: A course designed for welding technology majors and for people who are already in the industry working as welders. This course emphasizes welding structural steel with the five basic joint designs and open-root joints in plate and pipe applications. Training will be in all appropriate welding positions for plate and pipe. At the end of the course, welding technology majors are encouraged to take an all position certification test in accordance with AWS D1.1 Structural Welding Code book. Theory for this course includes cost analysis for both GMAW and FCAW processes and detailed discussions on current trend applications with today's equipment. Other topics include advanced features associated with new welding machines, mechanized equipment and robotic applications.
- WELD 1140 – Related Welding Processes** (5 credits; 3 lab, 2 theory)

Course Description: This course is designed for welding technology majors to expand their knowledge of specialized welding and joining processes. The practice portion of the course offers practical hands on experience using processes such as SAW, OFW, PAC, resistance spot welding, metal forming, casting, brazing, soldering and surfacing. The theory portion of the class will cover the above processes and some additional processes such as EBW, LBW, and explosive welding.
- WELD 1150 – Beginning Gas Tungsten Arc Welding (GTAW)** (5 credits; 3 lab, 2 theory)

Course Description: A course designed for welding technology majors that focuses on the Gas Tungsten Arc Welding (GTAW) process. The theory component of this course includes; fundamentals of the process, equipment features, electrode classification, shielding gases, base materials, joint designs and preparation, defects, safety aspects, and equipment trouble shooting. The shop portion of the class allows students to apply classroom theory and develop welding skills using the GTAW process.

- **WELD 1160 – Advanced GTAW** (5 credits; 3 lab, 2 theory)
Course Description: Theory of gas tungsten arc welding to include: Review of process fundamentals as it relates to welding, equipment, electrode type/classification, shielding gases, base materials, joint design and preparation, defects and safety aspects associated with the GTAW process. Advanced concepts and applications such as polarity characteristics, automation and reactive metals will be discussed. The interpretation and use of AWS pre-qualified welding procedure specifications (WPS) will be examined.
- **WELD 1500 – Professional Vocational Leadership** (1 credit – theory only)
Course Description: Supports and facilitates the goals and objectives of Vocational Industrial Clubs of America (SkillsUSA). Students gain skills in the following areas: personal development, service, team building and leadership, workplace skills, and interview skills. Students may participate in regional, state and national competitions.
- **WELD 2400 – Print Reading for Welders** (3 credits – theory only)
Course Description: This course is designed to enable welding technology students to interpret working sketches and engineering drawings (blueprints) common to the metalworking field. It introduces engineering drawings as the medium by which the engineer, designer or drafter conveys information to welders and other trades. Drafting concepts, sketching techniques, bill of materials, structural shapes, AWS welding symbols and dimensioning are covered from the specialized perspective of welded fabrication. Upon completion, the student will to have the ability to produce functional sketches and drawings, and interpret engineering drawings and welding symbols.
- **WELD 2410 – Practical Fabrication and Layout** (5 credits; 3 lab, 2 theory)
Course Description: This course is centered on the fabrication of actual projects and students must prepare and submit plans for projects to fabricate. Each set of plans must be approved and include complete sketches/drawings and a bill of materials. The course teaches measurement and layout methods, distortion control, and common design and fabrication errors that promote fatigue fracture. Computer Aided Drawing (CAD) and Computer Numerical Control (CNC) software are used as tools in the fabrication process, and are introduced through demonstrations and applications. Project planning, preparation and procurement are covered.
- **WELD 2500 – Weld Inspection** (3 credits – theory only)
Course Description: This course introduces the student to the basic responsibilities, skills and knowledge required to become a welding inspector. It is designed to help prepare the student for eventual Certified Welding Inspector (CWI) testing through the American Welding Society (AWS). The course consists of several modules on topics such as welding codes, processes, material properties, destructive and nondestructive testing

methods, metallurgy, welder and welding procedure qualification and welding discontinuities.

- **WELD 2600 – Metallurgy** (3 credits – theory only)

Course Description: Designed for welding technology majors. Beginning course which covers the study of metal characteristics and how those characteristics are affected by common welding techniques. Common heat- treating processes such as quenching, annealing, normalizing, tempering, and crystallization will be discussed. Students will learn to recognize the internal structures of various metals and metal identification techniques used in industry. Mechanical properties, failure and deformation, isothermal transformation diagrams and iron-carbon phase diagrams will be discussed.

Assessment Plan:

Assessments to be used in this plan:

1. NOCTI Welding Test

- **Summary:**

The National Occupational Competency Testing Institute (NOCTI) Welding Test reflects an individual's competency in welding technical knowledge, and includes measurable objective results in categories such as: safety, welding symbols and blueprint reading, oxy-fuel cutting (OFC), metallurgy, weld fit-up and quality, SMAW, GMAW, FCAW, and GTAW.

This evaluation serves as an independent assessment comparable to a national average.

- **Specific objectives measured:**

Learning objectives 1, 2, 3, 4, 5, 6, and 7 (all objectives listed)

- **Frequency of evaluation:**

Every three years

2. SkillsUSA Competitive Results – Welding and Welding Fabrication Contests

- **Summary:**

SkillsUSA is a national educational organization with a focus and commitment to education and enhancement of America's skilled workforce. Specifically, USU

Eastern's participation and performance in the Welding (Individual) and Welding Fabrication (three-member team) at the state and national levels will be evaluated.

This evaluation will also serve as an independent assessment to a national comparison group.

- **Specific objectives measured:**

Learning objectives 1, 2, 3, 4, and 5

- **Frequency of evaluation:**

Annually

3. GMAW/FCAW/GTAW Welder Performance Qualification Records (welding “certifications”)

- **Summary:**

Commonly referred to as certifications, Welder Performance Qualification Records (WPQR) provide documentation of an individual's successful attempt(s) to pass a hands-on welding assessment. In each advanced class (WELD 1110 - SMAW, WELD 1130 - FCAW, and WELD 1160 - GTAW) students will be administered a qualification attempt to AWS code requirements using a prequalified welding procedure from AWS B2.1.

- **Specific objectives measured:**

Learning objectives 2, and 6

- **Frequency of evaluation:**

Annually

4. Individual direct measures in all theory-only courses (WELD 2400, WELD 2500, and WELD 2600)

- **Summary:**

One signature assignment from each course listed above will be utilized to assess specific examples of student work to provide measurable assessment data for each course. The assessment used will be at the discretion of the faculty member who administers the course.

- **Specific objectives measured:**

Learning objectives 5, 6, and 7

- **Frequency of evaluation:**
Per course administration, with data compiled annually

Outcomes Data:

Assessment 1: NOCTI Test Results

USUE NOCTI Results				
Year	2017		2022	
	USUE	Nation	USUE	Nation
Safety	86.4	76.5		
Welding symbols and print reading	92.6	77.8		
OFC	79	61.2		
CAC-A and PAC	78.6	61.5		
Metallurgy	83.9	72.7		
Weld fit-up and quality	86	73.3		
SMAW	82.7	65.7		
GMAW and FCAW	80.9	63.3		
GTAW	82.2	68.7		
Total	83.2	68.6		

Assessment 2: SkillsUSA Competitive Results

SkillsUSA – Welding (Individual) Results		
Year	Utah	National
2008	1st	1 st
2009	1st	13 th
2010	1st	2 nd
2011	1st	5 th
2012	1st	5 th
2013	1st	5 th
2014	1st	N/A
2015	1st	29 th
2016	2nd	N/A
2017	1st	11 th
2018	1st	4 th
2019	1st	3 rd
2020	No contest held	
2021	1st	11 th
2022		

SkillsUSA – Welding Fabrication (3-member team) Results		
Year	Utah	National
2008	1st	1 st
2009	1st	3 rd
2010*	1st	1st
2010	1st	2 nd
2011	1st	1 st
2012	1 st	1 st
2013	2nd	N/A
2014	2nd	N/A
2015	1st	2 nd
2016	2nd	N/A
2017	2nd	N/A
2018	1st	1 st
2019	1st	1 st
2020	No contest held	
2021	1st	1st
2022	1st	

**Secondary (high school) division*

Assessment 3: WPQR Results

WPQR (Welder's Certifications) Results			
Year	GTAW	FCAW	SMAW
2021	2	5	3
2022		5	3

Assessment 4: Theory-only courses direct measures

WELD 2400 – Print Reading for Welders			
Semester	Assessment Used	Class Average	Comments
Spring 2020	Exam 1 – Print Reading	74%	See Appendix 1 – WELD 2400 Exam 1
Fall 2021	Exam 1 – Print Reading	78%	

WELD 2500 – Weld Inspection			
Semester	Assessment Used	Class Average	Comments
Spring 2022	Exam 1 – Weld Inspection	82%	-

WELD 2600 – Metallurgy			
Semester	Assessment Used	Class Average	Comments
Fall 2022		TBD	

Data-Based Decisions:

Assessment 1:

As this assessment is past due, the current action will be to **schedule the assessment** for completion during the Spring 2022 semester, and assess the outcomes of the exam afterward.

Assessment 2:

Our current action will simply be to **continue to excel** in the SkillsUSA contests mentioned. Additionally, we will explore participation in **additional** SkillsUSA competitions, such as Welding Sculpture.

Assessment 3:

This assessment is in the initial phases of implementation. Currently our action will be to **collect additional assessment data**. Specifically, the WPQR test results for GTAW need to be collected before this year's annual assessment data can be completed.

Assessment 4:

Like assessment 3, this assessment is also being newly implemented. So, our current action will also be to **collect additional assessment data** before we move forward. Specifically, direct-measure assessments will be collected in WELD 2400 (Fall 2021), WELD 2500 (Spring 2022), and WELD 2600 (Fall 2022).

Summary:

Half of the assessments in this assessment plan are being newly implemented as of this writing (October 2021), as such an additional action will be to **notify the program advisory committee (PAC)** of the updates made to the program assessment plan as well to ensure alignment with local and national industry standards and expectations.

Welding Technology AAS Curriculum

Requirements:

- **48 WELD Credits** (Note – WELD 1010 does not count to Welding AAS)
 - Beginning SMAW 1100 (5 credits)
 - Advanced SMAW 1110 (5 credits)
 - Beginning GMAW 1120 (5 credits)
 - Advanced GMAW 1130 (5 credits)
 - Related Welding Processes 1140 (5 credits)
 - Beginning GTAW 1150 (5 credits)
 - Advanced GTAW 1160 (5 credits)
 - Prof. Vocational Leadership (SkillsUSA) 1500 (1 credit)
 - Print Reading 2400 (3 credits)
 - Practical Fabrication and Layout 2410 (5 credits)
 - Weld Inspection 2500 (3 credits)
 - Metallurgy 2600 (3 credits)
 - Pipe Welding (New F22) (7 credits)
- **EDDT 1040 or EDDT 1200 or EDDT 2620** (3 credits)
- **ENGL 1010** (3 credits)
- **MACH 1010** (3 credits)
- **MATH 1020 or higher** (3 credits)
- **Human Relations or Business** (3 credits)
 - **BUSN 1010 (Business Principles)**
 - **BUSN 2320 (Small Business Management)**
 - **BUSN 1021 (Personal Finance)**
 - **BUSN 2200 (Business Communications)**
 - **CMST 1020 (Public Speaking)**
 - **CMST 2110 (Interpersonal Communications)**

- **Total: 63 credits required for graduation**

Notable Changes:

- **WELD Credits**
 - Pipe welding course added for Fall 2022
 - WELD 1010 no longer counts to Welding AAS
 - Increase WELD credit requirement from 46 to 48
- **EDDT Requirement**
 - Add EDDT 1200 as an option to complete this requirement
- **HR/BUSN Requirement**
 - Change in courses that satisfy this requirement
- **Elective Requirement**
 - Breadth requirement eliminated

Course Title: Advanced Pipe Welding
Course Number: WELD 1170
Credits: 7
Semester: Fall 2022
Meeting Time(s): 11:00-1:00 **Monday-Friday**
Instructor: Jeremiah Garcia
Office Hours:
Office Location:
Email:
Phone:

Course Description:

An advanced course for students who will pursue a career in petroleum pipeline welding. Pipe layout, fitting, and welding techniques will be covered extensively. Students also will learn proper use of pipeline-specific welding and cutting equipment, and industry-specific testing methods.

Prerequisites:

WELD 1110 – Advanced SMAW

Required Text:

The Pipe Fitter's and Pipe Welder's Handbook. 9780028024905

Course Objectives:

1. Become familiar with the safety aspects associated with pipe welding and general fabrication shop safety issues. Each student must complete a written safety test, at 80% or above, before being allowed to work in the shop.
2. Demonstrate competency in downhill pipe welding techniques using SMAW with a variety of electrode classifications and diameters.
3. Demonstrate pipe-welding competency using GTAW, GMAW, and FCAW.
4. Demonstrate a hands-on ability to properly layout, fit-up, and prepare open-root pipe joints for welding with various processes in the 1G, 2G, 5G, and 6G positions.
5. Be familiar with current industry trends and best practices in the specific field of pipe welding.
6. Demonstrate an ability to pass industry-specific testing criteria for pipe welding employment.

USUE Welding Technology PAC Meeting Minutes

April 29, 2022 Agenda

Release Date: May 2, 2022

In Attendance:

Jeremiah Garcia – Instructor

Dusti Jones – FlowServe

Jake Clement – Instructor

Troy Anderson – Pacificorp

Austin Welch – Assistant Professor

Mike Tryon – Intermountain Electronics

Not in Attendance:

Chad Cloward (Chair) – Solvay Chemicals

Agenda

1. New Instructors

- Lon Youngberg (retired) and Mason Winters (resigned) left following the Spring 2021 semester.
- Jeremiah Garcia and Jake Clement hired starting Fall 2021 semester.

The committee was introduced to Jake Clement and Jeremiah Garcia. Jake and Jeremiah discussed their background and credentials with the committee, and were well received. No concerns were expressed.

2. Curriculum Update

- Changed requirements for AAS graduation

Committee was informed of all curriculum changes. It was noted that students who still wished to complete breadth courses could do so. Also, the committee was very approving of the Personal Finance (BUSN 1021) as a new option for fulfilling the HR or BUSN requirement of the AAS.

- Pipe Welding course offering starting F22

Committee was informed. The committee asked if there was going to be training included performing a root-pass with RMD (Miller-specific welding program), and a FCAW cap. Jeremiah remarked that it was a possibility, and Austin noted that an RMD root and FCAW cap are already included in the WELD 1130 (Advanced GMAW/FCAW) course curriculum.

- Course offerings have expanded to evenings and summer

Austin explained the expanded course offerings. It was noted to the committee that this expansion was largely influenced by non-degree seeking students who are trying to complete the necessary requirements for a Journeyman Mechanic position at Pacificorp (18 WELD credits required).

Troy asked if it was possible to include training for Certified Welding Inspectors (CWIs) in these time-blocks. Troy noted that many of Pacificorp's CWIs would benefit from in-depth welding training, as many of them have not worked as hands-on welders before.

Austin noted that the program could explore offering short-term intensive non-credit training to meet this need.

Action Items:

- *Work with Pacificorp to explore options to meet the need for this training in a short-term, non-credit training solution.*
 - *Additionally: review the AWS Specification for structuring the above-mentioned training in such a way that it meets AWS requirements for offering Professional Development Hours (PDHs) for those CWIs who attend.*
3. Increased program completion rates
 - Completions increased from 5 to 18 from 2020 to 2021

The committee acknowledged the information.

4. Equipment Funding
 - Awarded approx. \$145k for equipment – due to increased completion rates

The committee was informed that the money was awarded partially due to the increase in program completions. The committee discussed what types of equipment the funding was allocated for – most particularly the Laserstar laser welding unit.

5. New Program Assessments
 - Updated Program Assessments
 - Pre-test/post-test has been eliminated
 - Assessments now include: NOCTI, Direct Measures (course test scores), welding certifications, and SkillsUSA results

Committee was informed of the transition for the old assessments to the new assessments. Dusti asked if program placements were included as an assessment. Austin informed her that they were not, however program placement data is being collected anyway, and should be considered as an assessment measure.

Action Items:

- *Consider including program placement data as a program assessment on the next assessment update.*
6. Jordan/Competition Update
 - Jordan placed 2nd in USA Weld Trials
 - Will represent United States at WorldSkills if SkillsUSA participates

- Fabrication team won 4th consecutive ULSC gold, will pursue 4th consecutive national title in June

Topic was discussed. The committee asked why the decision of participation in WorldSkills was not ensured at this time.

7. Program Alignments

- USHE and UCAT(UTECH) were combined through the legislature in 2020
- USHE has directed all CTE programs statewide (UTechs and colleges/universities) to implement a 70% curriculum alignment in similar programs (like welding) at a Certificate level
- Current anticipated updates to courses/curriculum – possibly starting Fall 2023

The committee was informed of the current alignment situation as it pertains to Welding Technology.

Concerns/Comments included:

- *What are the reasons for this initiative?*
- *Mike encouraged training hours to be aligned for all four processes. Austin informed him that was a specific goal for the alignment initiative at the Certificate level (currently: 120 hours/process is suggested).*
- *Mike and Dusti were notified that the alignment did not include welding theory/lecture statewide, but USUE would still require theory instruction for graduates. Mike and Dusti were both concerned that other institutions were not including this instruction.*
- *Mike suggested contacting employers of UTECH certificate completers and asking if they were satisfied with theory/lecture instruction. Specific questions he encourages asking included:*
 - *Do they require additional training?*
 - *Do they know how to read prints?*
 - *Do they understand how to use weld gauges?*
- *The committee remarked that program-alignment type initiatives should be primarily driven by concerns for the quality of training received.*
- *Troy mentioned that Pacificorp has noted that former students from our program behave much safer in the workplace than others- particularly those with primarily on-the-job training.*

Action Items:

- *Inform members of the Welding Technology Program Alignment Committee of the information mentioned above.*

8. Invite committee comments, suggestions, and questions

Topics of discussion included:

- *How often should the PAC committee meet?*
 - *The committee agreed that we should meet biannually.*

- *Dusti Jones was elected as committee chair. Chad Cloward (not in attendance) will remain a PAC committee member.*
- *Troy mentioned that Pacifcorp has an acute need for Journeyman Mechanics. He mentioned that USUE can satisfy the requirements for welding (18 credits) and machining (18 credits), but not industrial mechanics (6 credits), and Pacifcorp has been forced to send some employees to Rock Springs, Wyoming (Western Wyoming Community College) to complete the training – despite the fact that almost all of the students in question are from Carbon and Emery counties.*
 - *Austin mentioned that 18 credits of welding does not meet Certificate requirements, so many of the students who seek to meet those requirements for Pacifcorp count as non-completions for the welding program.*
 - *Austin mentioned that Nathan Madsen teaches some industrial mechanics courses, but his program was called “Automated Manufacturing.”*
 - *Troy was not sure that those courses would meet the requirements mentioned.*
- *Troy mentioned that many welding-employees disregard the severity of unintentional arc strikes as weld defects.*
- *Austin informed the committee of the program’s need for material donations from industry. The committee acknowledged their willingness to help.*
- *The committee was informed of another potential PAC committee member joining the committee in time for our next meeting.*

Action Items:

- *Explore the possibility of offering a program of study Certificate that meets Paciforp’s Journeyman Mechanic education requirements (18 welding credits, 18 machining credits, and 6 industrial mechanics credits).*