Eastern Center for Arts and Technology

Program Review

Welding Technology

2024

Occupational Data Analysis for Welding Trades Program Review
Data from the O-Net Online occupational data report (51-4121.06) indicates that welders, cutters and welder fitters held approximately 428,000 jobs in the United States in 2021. Opportunities for these workers are projected to grow 2% in the United States, which is slower than average. In Pennsylvania, the projected growth is 7%. These numbers are in contrast with the projections from the American Welding Society (AWS) which predict that the U.S. will need approximately 360,000 new welding professionals by 2027. There are 90,000 welding jobs projected to be filled annually between 2023–2027. Jobs are concentrated in the manufacturing and construction areas; however, advanced manufacturing technology has expanded the opportunities for welders. Many of these opportunities require welders that are highly trained, highly educated and have specific credentials to ensure quality work with new materials in the fields of aerospace, automotive, electronics, oil and gas, and shipbuilding industries.

The median wage for all welders nationally in 2021 was $47,540 per year. The rate for welders varies widely as do the specific trades welders work in. The median wage for all welders in the state of Pennsylvania is $47,360. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. In the United States, the lowest 10 percent earned less than $35,380, and the highest 10 percent earned more than $68,750.

Locally, the manufacturing industry is steady and provides numerous opportunities for welders using various welding processes including gas metal arc welding, shielded metal arc welding, flux cored arc welding and gas tungsten arc welding. Many local (Montgomery County and Philadelphia area) welding trade related unions are seeing a shortage and are recruiting entry level welders.

Program Data Analysis for Welding Trades Program Review
Data for enrollment for EASTERN as a whole shows enrollment at 82% in the 2022-2023 school year, which is down slightly from previous years. In comparison, the data for Welding Technology shows enrollment at 100% in 2022, 2021, and even higher (105.6%) in 2020. Since the last program review, Welding Technology has had a significant wait list each year (20 or more students on wait list). EASTERN's attendance goal of 94% is slightly higher than the 90.9% attendance rate that Welding Technology had in 2022. Data prior to COVID (2019) shows attendance at 93.2% and in 2020 at 96.0%.

Data for retention for EASTERN as a whole shows a retention goal of 85%. The data for Welding reflects an 81.1% retention rate for 2022. Prior to that, retention was at 96.2% in 2021, 92.3% in 2020, and 90.9% in 2019. The low retention data for 2022 is due to a student moving and students not returning to the program due to lack of credits at their sending school.

The completion goal for EASTERN as a whole is 73%. In 2022, Welding Technology had a completion rate of 72.7%, which is lower than previous years (80.8%-2021, 84.6%-2020 and 86.4%-2019). In 2022, the CIP code task list 48.0508 has been updated and tasks that state "weld in all positions" have been broken out into individual tasks per position (flat, horizontal, vertical and overhead). This created more tasks for students to complete and could have contributed to the low completion rate for Welding Technology.

EASTERN's placement goal is 84% and in 2022, Welding Technology's data reflects a placement rate of 42.3%, which is significantly lower than EASTERN's goal. This data is measured by a post-graduate survey completed in October by graduates. In the 2021-2022 school year, many students in the Welding Technology program chose to work in a field unrelated to welding, having made a decision to do so prior to entering EASTERN.

Data for NOCTI shows that EASTERN's goal for competent or advanced scores is at 91%. In 2019, Welding Technology's rate was at 100%, in 2020 at 100%, in 2021 at 95% and in 2022 at 87.5%. The number of students who scored advanced on the NOCTI in 2019 was 100%, in 2020 at 87.5%, in 2021 at 65% and in 2022 at 50%. The trend for both sets of data shows a decline in scores. This could be due in part to a rise in students with specific needs or IEPs in the program. EASTERN's goal of students earning an industry certification is at 70%, and Welding Technology's data shows that 100% of students earned industry certifications in 2019, 2020, 2021 and 2022.

The overall expectations and standards for student performance in the program remain high, aligning with what the OAC members believe to be crucial in producing quality welding graduates. The OAC stressed a pertinent need for quality workmanship and work ethic and those expectations are being met within the program now.

NOCTI data from the written portion of the assessment (pre and post-test) reflects that the areas of lowest achievement are Arc Cutting Process, Physical Characteristics and Mechanical Properties of Metals, and Oxyfuel Cutting. The OAC recommends that emphasis be placed on these areas with the support of audiovisual aids and more hands-on application, particularly in the areas of Arc Cutting, Physical Characteristics and Mechanical Properties of Metals and Oxyfuel Cutting.

Program Specific Questions – Welding Technology

What are the current and/or new industry certifications available for students in the program?
Welding certifications for the most part are governed by two separate codifying bodies: ASME (American Society of Mechanical Engineering) and AWS (American Welding Society). AWS is the code that is associated with much of the building industry while ASME is the prevalent governing body in the process industries. Certification in the welding industry has traditionally been the responsibility of the employer with welders having to certify every time they change employer, add a new process or position, or sometimes even when welding at a new client site. The employer would qualify a procedure and its associated quality assurance, and then the welder would certify to the qualified procedure. In recent years, AWS has begun publishing prequalified procedures, and there are testing labs that will certify welders to those procedures: however, there is no guarantee that an employer will accept these certifications. In fact, most employers continue to recertify newly hired welders at the time of employment.

That being said, demonstrating that one has been certified before (even if the employer intends to certify in-house) may make a prospective hire more attractive to that employer and increase their chance of being hired. As of February of 2017, the welding instructor at EASTERN is a CWI (Certified Welding Inspector) under the AWS code D1.1 and a partnership has been made with WTTI (Welder Testing and Training Institute) allowing the welding instructor to be able to supervise/facilitate welder qualification tests at EASTERN. The partnership is referred to as an RTF (Remote Testing Facility), and it ensures quality control over machine calibration and testing materials, ethics of supervising testing, and both destructive and nondestructive testing of completed test plates. It should be pointed out that this prequalification model exists only under the jurisdiction of AWS and does not exist in ASME. Students can earn the D1.1, with the first attempt being paid for by a grant. Approximately 30% of 12th grade students took

the D1.1 in the 2021-2022 school year. Approximately 25% of the 12th grade students took the D1.1 in the 2022-2023 school year.

Are there any post-secondary opportunities (dual enrollment, articulations) for graduates of the program?
EASTERN currently has an articulated credit agreement with nine Pennsylvania Colleges (see attachment 1). The opportunity for dual enrollment with Pennsylvania College of Technology is currently being set up and should be available for the welding technology program beginning in the 2024-2025 school year.

What welding processes are most popular currently in industry?
According to data from the Bureau of Labor Statistics, as of 2021, the most in-demand type of welding is gas metal arc welding (GMAW), also known as metal inert gas (MIG) welding. This type of welding is commonly used in the manufacturing and construction industries and is known for its speed, easy level or difficulty and versatility. Other in-demand types of welding include flux-cored arc welding (FCAW) dual-shield, gas tungsten arc welding (GTAW), and shielded metal arc welding (SMAW). None of these processes have become archaic or outdated and are still used rigorously in industry.

Industry Trends

The welding industry is requiring more of welders than it historically has. Welders must be able read prints, problem-solve, troubleshoot, inspect welds and complete quality control, run multiple welding processes, complete fit-up and layout, fabricate, etc.

The welding OAC stresses that many industry trends concern the process of Gas Tungsten Arc Welding (GTAW). The use of a ER6010 root pass on both pipe and plate applications has been replaced by a GTAW root pass. This means that welders who work predominantly with the Shielded Metal Arc Welding (SMAW) process need to also be proficient with the GTAW process. GTAW is historically much more difficult to produce and therefore there are less welders in the country who are proficient or trained in GTAW.

The welding OAC recognizes and stresses the need for more attention and time spent on pipe welding, although pipe welding is not a specific task on the CIP code. Many unions and private companies are hiring new employees on a tier based on experience, with experience with pipe welding being at the top of the tier.

Any welders who have pipe experience have an advantage over a welder who was only trained in plate or one specific kind of welding.

The use of orbital welders, as well as semi-automatic GTAW processes are becoming popular and very efficient. Historically, GTAW has been a slower and more selective welding process; however, industry advances are making it more attractive to manufacturers. The hot wire TIG (GTAW) process is a further development of mechanized TIG. The high deposition rates are achieved in combination with the first-class quality traditionally expected from TIG processes. This process is in demand for welding with offshore pipeline, cross country pipeline, shipyards, piping fabrications for modules construction and petrochemical industries.

The most common trend in the welding industry is the need for welders to be able to do more than one process of welding. Welders need to have training and knowledge of all welding processes, knowing the right application for each one. Welders need to know a variety of fabrication techniques, including fit-up, measuring and using other equipment like angle grinders and die grinders.

Recommendations

Currently, the majority of the power sources (welding machines) in the welding technology program are at least 15-20 years old. A replacement cycle will be implemented beginning in the current school year. During the 2022-2023 school year, 5 power sources (Miller XMT machines that were at least 20 years old) broke and were not fixable. They were replaced by new Miller power sources that run multiple processes. This created a difficult teaching situation for the instructor logistically as students had to share equipment while waiting for new equipment to arrive at the school. In an effort to reduce the downtime, the oldest welding machine(s) will be replaced each year, regardless of their working condition.

Virtual welder – Miller, Lincoln

The cost of supplies like metals, gases and consumables has increased significantly in the past 5 years. As a cost-saving solution for welder training, many training facilities are moving to virtual welding as part of their curriculum. Virtual welding provides the welder with an opportunity to practice changing welding variables angles, travel speed and arc length. As of right now, there are two welding equipment companies that make virtual welding systems: Miller and Lincoln. The Miller system has two versions, one more complex than the other. Lincoln only has one model, comparable to Miller's more complex model. This kind of technology in the classroom could be really good for the right kind of student.

CAD-3D printer

The Welding Technology program at EASTERN would like to work on joint projects that involve other programs, specifically Robotics. The OAC recommends that the Welding Technology program purchase a 3-D printer to aid in the design and fabrication of welded projects. 3-D printers are reasonably priced as compared to 5 years ago. It has also been stressed that the student's ability to read weld prints -11f \ is vital in industry. The implementation of using Auto-CAD or a similar platform is recommended. If students learn how to make their own drawings, they will have a better understanding of how to read them. Having the students use auto-CAD will help streamline students designing and fabricating their own projects and live works within the program. If we select a program like Solidworks, that could help link the use of a 3-D printer with students earning an industry certification (Solidworks).

Maintenance and Replacement Schedule

The age of eight of the welding machines in the program is over 20 years old, which is close to the average life expectancy of a welding machine made by Miller or Lincoln. Instead of waiting for these machines to stop working, it is recommended that 1-2 of the oldest welding machines get replaced every year, regardless of whether or not they work properly, until all of the welding power sources are under ten years of age. This will help keep the shop running smoothly with no unnecessary down time due to equipment malfunction. An added benefit to implementing this system is that the newer machines are much smaller than the older machines and will take up less room in the shop. Space is at a premium in the program. Machines will also be blown out with compressed air every 6 months. This will be completed by the facilities department. This process involves taking the covers off of each machine and can be time consuming. It is recommended that this happens during the winter break and the summer break.

Pipe

Pipe welding is a very common type of welding that can be found in the industry. In talking to local trade unions like the Ironworkers, Boilermakers and Steamfitters, and other apprenticeships like Rhoades Industries, it was expressed that welders coming out of high school that have a pipe certification or can pass a pipe qualification test are in very high demand. Pipe welding falls into the curriculum under the welding processes of SMAW, GMAW, FCAW and GTAW. In order to make the most of the two years that students are in the program, it is recommended that a piece of equipment to bevel pipe should be purchased. Beveling pipe by hand can be time consuming and is not a skill that takes long to

master. If students could spend more time fitting up and welding their pipe welds, they would be much more successful in the program.

Summary

Welding technologies are a critical trade in the construction, manufacturing and other industrial employment sectors. In particular, construction and infrastructure projects do not lend themselves to outsourcing, and are expected to provide a steady need for welders in the future. The current retirements of a generation of welders coupled with the decreased emphasis in trades education over the last few decades are predicted to result in a shortage of approximately 350,000 welders in the near future. Welding remains a well-paying, viable trade in the foreseeable future. EASTERN's Welding Technology program effectivity specializes in developing basic practical and soft skills targeting entry level employment.

Implementation Timeline

Phase One – 2025-2026

- Lincoln welder (replacement)
  Flextec® 350XP (Twist Mate®)280 series with wireless foot control – $5944.00

Total $5944.00

Phase Two-2026-2027

- Lincoln welder (replacement)
  Flextec® 350XP (Twist Mate®)280 series with wireless foot control – $5944.00
- 3D printer - $500.00
- Pipe Beveler –
  Electric Plate and Pipe Beveler by Baileigh or Steelmax - $5000.00

Total $11,444.00

Phase Three – 2027-2028

- Lincoln welder (replacement)
  Flextec® 350XP (Twist Mate®)280 series with wireless foot control – $5944.00
- Miller MobileArc Augmented Reality Welding System - $3000.00

Total $8,944.00

Program Review Total $27,232