

Welding Technology

Overview

The ARC Welding Technology department offers students the opportunity to pursue an Associates in Science degree or several certificates. The department is committed to preparing students for success in an exciting, in-demand career field.

Our faculty have decades of industry experience. They work closely with local employers and our partners with [the American Welding Society \(https://www.aws.org/\)](https://www.aws.org/) to ensure that you will gain the skills and training to have a successful career.

Roadmaps

Road maps lay out all of the courses you need to take for a given degree or certificate.

[Get a Road map! Explore Ways to Complete These Programs \(/academics/arc-program-road-maps\)](#)

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Associate Degree

A.S. in Welding Technology

The Welding Technology degree provides skills and knowledge in manual and semi-automatic welding processes used in the metal fabrication and construction industries. Instruction covers materials, equipment, procedures, testing techniques as well as safety and blueprint reading. Competencies include techniques of joining ferrous and non-ferrous metals by the use of Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Gas Tungsten Arc Welding (GTAW), and welding procedures.

Catalog Date: January 1, 2021

Degree Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 140	Mathematics for Welding Technicians	3
WELD 300	Introduction to Welding	3
WELD 302	Introduction to Welding Metallurgy	3
WELD 316	Welding Inspection	2
WELD 320	Shielded Metal Arc Welding – Structural	3
WELD 322	Shielded Metal Arc Welding (Pipe)	3
WELD 330	Gas Tungsten Arc Welding (Plate)	3
WELD 332	Gas Tungsten Arc Welding (Pipe)	3
WELD 333	Gas Metal Arc Welding, Steel	3
WELD 334	Gas Metal Arc Welding: Ferrous and Non-Ferrous Metals	2
WELD 335	Flux Core Arc Welding	3
WELD 342	Symbol Reading, Layout and Fabrication	3
Total Units:		34

The Welding Technology Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- select the correct electrode classification and parameters for various thickness of material and welding positions on ferrous and nonferrous metals.
- define principles of gas metal arc welding.
- interpret GMA electrode and classification and specification.
- describe gas metal arc (GMA) welding operations of various joint designs using selected electrodes on different positions.
- describe shielded metal arc welding operations of various positions using selected electrodes on different joint designs.
- define principles of arc welding.
- select correct electrode amperage settings for the job application.
- identify gas tungsten arc (GTA) welding principles and safe welding practices.
- define GTA applications and limitations.
- explain the reason for the formation of each discontinuity type, and distinguish different discontinuities.
- interpret fabrication blueprints using a systematic process.
- interpret graphic welding symbols.

- relate the requirements for welding ferrous and nonferrous metals.
- select the appropriate setting and application methods.
- list the methods used for discontinuity prevention and identify surface defects in welds.

Career Information

Welding certification is recognized by the welding industry as an important step in the profession. The American Welding Society (AWS) nationally accredits American River College's welding program. The ARC welding program has met all the requirements of the AWS QC4 standards for Accreditation of Test Facilities for their Certified Welder Program. Graduating students may find positions in oil refineries, nuclear power plants, aerospace, structural buildings, bridge construction, auto industry, and small commercial fabricating shops.

Certificates of Achievement

Shielded Metal Arc Plate and Pipe Certificate

This certificate promotes competence in plate and pipe welding. Emphasis is on power sources, electrode selection on various joint designs, techniques, and positions in welding. Instruction includes safety and proper procedures in making fillet and groove welds that are in compliance with structural and pipe welding codes.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 300	Introduction to Welding	3
WELD 320	Shielded Metal Arc Welding – Structural	3
WELD 322	Shielded Metal Arc Welding (Pipe)	3
Total Units:		9

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- interpret electrode classification and specification
- select correct amperage setting for the job application
- define principles of arc welding
- certify and perform SMA operations in various positions using selected electrodes on different joint designs

Welding Metallurgy and Inspection (270 hours) Certificate

The Welding Metallurgy and Inspection certificate provides the science of metallurgy and weld inspection. Emphasis is on the identification and selection of irons and steel, mechanical and physical properties of metals and crystal structures of metals, rules and regulations of the welding construction industry, and principles, requirements and methods of inspection.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 302	Introduction to Welding Metallurgy	3
WELD 316	Welding Inspection	2
WELD 117	Ultrasonic Testing Level One	3
WELD 118	Ultrasonic Testing Level Two	3
WELD 300	Introduction to Welding	3
Total Units:		14

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Describe the mechanical properties of different types of metals
- Interpret and explain the Nondestructive Testing (NDT) procedures of codes and specifications relating to welding
- Evaluate and explain in simple terms the reason for the formation of discontinuity in each of the welding processes
- Explain different methods used for the prevention of weld discontinuities
- Describe the crystalline structures of metals and explain how grain forms in metal
- Explain the problems hydrogen causes when welding steel
- Analyze phase diagrams of carbon and stainless steels

Welding Technology Certificate

This certificate provides skills and knowledge in manual and semi-automatic welding processes used in the metal fabrication and construction industries. Instruction covers materials, equipment, welding procedures, testing techniques, inspection, welding metallurgy, blueprint reading, and welding safety. Competencies include techniques of joining ferrous and non-ferrous metals by the use of Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Gas Tungsten Arc Welding (GTAW). Oxyacetylene welding, oxyacetylene cutting and plasma arc cutting, are also covered.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 140	Mathematics for Welding Technicians	3
WELD 300	Introduction to Welding	3
WELD 302	Introduction to Welding Metallurgy	3
WELD 316	Welding Inspection	2
WELD 320	Shielded Metal Arc Welding – Structural	3
WELD 322	Shielded Metal Arc Welding (Pipe)	3
WELD 330	Gas Tungsten Arc Welding (Plate)	3
WELD 332	Gas Tungsten Arc Welding (Pipe)	3
WELD 333	Gas Metal Arc Welding, Steel	3
WELD 334	Gas Metal Arc Welding: Ferrous and Non-Ferrous Metals	2
WELD 335	Flux Core Arc Welding	3
WELD 342	Symbol Reading, Layout and Fabrication	3
Total Units:		34

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- list the factors that must be considered before a welding process is selected
- evaluate a weld according to a given standard or code
- compare the three types of welding current used for Gas Tungsten Arc Welding
- define voltage, electrical potential, amperage, and electrical current as related to Gas Metal Arc Welding
- discuss how the Gas Metal Arc Welding molten weld pool can be controlled by varying the shielding gas, power settings, weave pattern, travel speed, electrode extension, and gun angle
- explain what each of the digits in a standard Flux Cored Arc Welding electrode identification number mean
- list and define the three units used to measure a welding current
- give the characteristics of the three filler metal groups E6010 and E6011, E6012 and E6013, and E7016 and E7018
- discuss three general categories of pipe welds including how they are used and what type of weld root penetration and strength they require
- make a single V-groove butt welded joint on a pipe in any position to code specifications
- list the crystalline structures of metals and explain how grains form
- describe practical applications of metallurgy
- solve basic welding fabrication math problems
- read a set of welding blueprint drawings and explain each item shown and its dimensioning

Career Information

Graduates may find employment in a number of industries including; pipe line construction, oil refining, aerospace, structural building, bridge construction, automotive, and small commercial fabricating. They may also work as welding shop supervisors and welding sales persons, and they can also become welding shop owners.

Certificates

Gas Metal Arc and Flux Core Arc Welding Plate (252 hours) Certificate

The Gas Metal Arc Welding certificate promotes competence in welding with different types of metal transfer, constant voltage power sources, different types of shielding gases, and electrode selection on various joint designs. Instruction is provided in gas metal and flux cored arc welding on fillet and groove welds to specific structural and pipe standards.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 333	Gas Metal Arc Welding, Steel	3
WELD 334	Gas Metal Arc Welding: Ferrous and Non-Ferrous Metals	2
WELD 300	Introduction to Welding	3
WELD 335	Flux Core Arc Welding	3
Total Units:		11

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- select the correct electrode classification and parameters for various thicknesses of material and welding positions on ferrous and nonferrous metals
- define principles of gas metal arc welding
- interpret electrode classification and specification
- analyze gas metal arc welding operations on various joint designs using selected electrodes for different welding positions

Gas Tungsten Arc Plate and Pipe Welding (180 hours) Certificate

The Gas Tungsten Arc Welding certificate promotes competence in welding ferrous and nonferrous materials. Emphasis is on proper use of gas tungsten arc welding (GTA) equipment setup requirements, process variables, material requirements, and welding procedures that are in compliance with industry standards.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 330	Gas Tungsten Arc Welding (Plate)	3
WELD 300	Introduction to Welding	3
WELD 332	Gas Tungsten Arc Welding (Pipe)	3
Total Units:		9

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- identify GTA principles and safe practices.
- define GTA applications and limitations.
- weld mild steel, stainless steel, and aluminum alloys using GTA procedures in all positions.
- evaluate and demonstrate procedures for a given welding project or application.
- relate the requirements of welding ferrous and nonferrous materials.
- select the appropriate settings and applications methods of GTA process.

Pipe Welding Certificate

This certificate promotes competence in pipe welding with emphasis on power sources, electrode/filler metal selection on various joint designs, techniques, and positions for welding. Instruction includes safety, math, and proper procedures in making fillet and groove welds that are in compliance with structural and pipe welding codes.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 140	Mathematics for Welding Technicians	3
WELD 322	Shielded Metal Arc Welding (Pipe)	3
WELD 332	Gas Tungsten Arc Welding (Pipe)	3
Total Units:		9

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- interpret electrode and filler metal classifications and specifications.
- select correct amperage setting for the job application.
- define principles of arc welding.
- perform Shielded Metal Arc Welding and Gas Tungsten Arc Welding operations in various positions using selected electrodes on different joint designs.
- use math in welding applications.

Career Information

Certificate completers may find employment in a number of industries, including PG&E pipeline construction, oil refining, power generation, structural building, bridge construction, and small commercial fabricating shops.

Welding Equipment Maintenance and Blueprint Interpretation (234 hours) Certificate

This certificate promotes competence in solving equipment, mathematical and manufacturing problems that apply to the welding trade. It emphasizes metal placement, measurement, and layout of tools used in construction, as well as the fundamentals of blueprint reading and welding equipment repair.

Catalog Date: January 1, 2021

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
WELD 107	Welding Equipment Maintenance	3
WELD 140	Mathematics for Welding Technicians	3
WELD 300	Introduction to Welding	3
WELD 342	Symbol Reading, Layout and Fabrication	3
Total Units:		12

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate algebraic expressions by substituting given numbers for letter values
- solve formulas by substituting numbers for letters, analyzing word statements and diagram values
- compute the area, radius, and diameter of a circle
- compute area, radius, and central angles of a sector
- measure angles in degrees, minutes, and seconds
- identify and demonstrate the proper use of common power tools and accessories used in the welding trade

- interpret fabrication blueprints using a systematic process
- interpret graphic welding symbols
- interpret electrical and electronically controlled circuits
- evaluate testing equipment used for welding maintenance repair

Welding (WELD) Courses

WELD 105 Introduction to Metal Sculpture

Units: 1.5
 Hours: 18 hours LEC; 27 hours LAB
 Prerequisite: None.
 Catalog Date: January 1, 2021

This course covers metal sculpture techniques, design principles, and materials used for sculpture for functional and nonfunctional art forms, on ferrous and non-ferrous metals. Techniques on the major welding processes such as Shielded Metal Arc, Gas Metal Arc, Gas Tungsten Arc, and Oxy-Acetylene are an integral part of the course, as well as related safety issues.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- apply safety standards to each welding process and other related metal working equipment.
- apply traditional and non-traditional metal working techniques to design and execute 3-dimensional functional and nonfunctional art forms.
- utilize welding and cutting processes to construct art projects.
- inspect welding for projects and make corrective changes to create structurally sound connections.

WELD 107 Welding Equipment Maintenance

Units: 3
 Hours: 36 hours LEC; 54 hours LAB
 Prerequisite: None.
 Catalog Date: January 1, 2021

This course covers the basics of welding equipment maintenance, troubleshooting, and repair. Electrical and electronically controlled circuits are discussed and tested. Overall theory of operation and safety are presented, as well as maintenance scheduling and the use of electronic test equipment and other measuring devices. Field trips may be required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify the electronic components of a welding power supply
- evaluate the operating characteristics of various types of welding equipment
- conduct research on the operation and purchase of welding equipment components that require replacement or repair
- apply critical thinking analysis towards the troubleshooting and repair of welding equipment
- properly use test equipment needed in the problem solving and repair of nonoperational equipment
- apply the required knowledge of the electrical components and their connection to welding power supplies to produce satisfactory welds
- determine the proper way of connecting welding equipment to the correct power source during the installation process
- apply the required safety procedures when maintaining or repairing any type of welding equipment

WELD 115 Code Welding

Units: 2
 Hours: 18 hours LEC; 54 hours LAB
 Prerequisite: WELD 300 with a "C" grade or better, or a minimum of one year of welding experience.
 Catalog Date: January 1, 2021

This course provides individualized training for welder performance qualification. Code and test requirements are presented. Welders select the code, metal, process, and positions to be used. Preparation for competing in the SkillsUSA regional, state, and national competition is also covered. This course may be taken up to four times for credit with different competitions. A field trip and participation at the site of the SkillsUSA regional competition are required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- perform arc welding that meet SkillsUSA standards.
- analyze welding projects and make corrective changes to meet SkillsUSA standards.
- understand the parameters of a specified welding procedure.
- apply safety rules and regulations for welding and metal cutting.
- explain the variables for each chosen process.
- explain the requirements for the SkillsUSA competitions.

WELD 117 Ultrasonic Testing Level One

Units: 3

Hours: 45 hours LEC; 27 hours LAB
Prerequisite: None.
Catalog Date: January 1, 2021

This course covers the theory, technique, application, and evaluation used in the material processing, welding, and inspection industries. Ultrasonic testing as applied to industry practices, such as building construction, aeronautics, shipbuilding, materials fabrication, and others, is covered. Successful completion of this course certifies that the requirements of the American Society of Nondestructive Testing (ASNT) TC-1A for UT level I are met.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- perform basic material testing.
- explain the basic physical principles of ultrasonic testing.
- describe basic ultrasonic machine functions.
- perform basic machine and testing calibrations.

WELD 118 Ultrasonic Testing Level Two

Units: 3
Hours: 45 hours LEC; 27 hours LAB
Prerequisite: WELD 117 with a "C" or better, or evidence of completion of UT Level I certification.
Catalog Date: January 1, 2021

This course covers advanced theory, technique application, and evaluation techniques used in the material processing, welding, and inspection industries. It covers advanced ultrasonic testing as applied to industry practices such as building construction, aeronautics, shipbuilding, and materials fabrication. Successful completion of this course meets the requirements of the American Society of Nondestructive Testing (ASNT) TC1-A for Ultrasonic Testing Level II.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- calibrate an ultrasonic testing machine to the proper standards.
- demonstrate proper techniques when examining materials and/or welds.
- evaluate ultrasonic test results to ensure they meet code requirements.
- perform inspections that meet industry standards.

WELD 140 Mathematics for Welding Technicians

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
General Education: AA/AS Area II(b)
Catalog Date: January 1, 2021

This course covers the application of mathematics principles in technical and trade work. Areas covered are fundamentals of general mathematics, common fractions, decimal fractions, percent, signed numbers, measurements, customary measurement units, metric measurement units, steel rules and vernier calipers, fundamentals of algebra, basic algebraic operations, fundamentals of plane geometry, triangles, polygons, circles, areas, volumes, and fundamentals of trigonometry.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- interpret and apply common welding formulas
- demonstrate problem-solving skills for technical and trade work
- analyze problems that are encountered in metal fabrication
- solve equations needed in the welding field

WELD 150 Employability Skills for Technical Careers

Same As: AT 107 and ET 250
Units: 2
Hours: 36 hours LEC
Prerequisite: None.
Advisory: ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320, ESLL 320, and ESLW 320 with a grade of "C" or better.
General Education: AA/AS Area III(b)
Catalog Date: January 1, 2021

This course provides the opportunity to explore technical careers while developing valuable work and life skills. It is an introduction to a variety of technically-related occupations, emphasizing technical careers in the Sacramento area. Activities are designed to enhance personal development, employability skills, and self esteem through leadership, citizenship, and character development. This course is not open to students who have completed AT 107 or ET 250.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify personal interests.
- demonstrate effective communication skills.
- demonstrate personal qualities that are desirable in the workplace.
- create long-term and short-term goals.

WELD 155 Industry Training

Units: 3
Hours: 36 hours LEC; 54 hours LAB
Prerequisite: None.
Catalog Date: January 1, 2021

This course covers welding processes, knowledge, and skills specific to employers' needs. Workplace safety and etiquette are included. Metal fabrication skills for specific employment needs and welding certification testing are covered if requested by employers.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- select welding process and fabrication variables.
- prepare metal fabrications to basic prints.
- produce welds to code standards.
- demonstrate proper workplace etiquette.

WELD 294 Topics in Welding

Units: 0.5 - 5
Hours: 9 hours LEC; 27 - 270 hours LAB
Prerequisite: None.
Catalog Date: January 1, 2021

This course provides an opportunity to study current topics in welding technology that are not included in existing courses.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- research the specialized needs of a manufacturer
- formulate tasks related to the specific needs of the company
- access information effectively and efficiently for welding standards used in manufacturing
- evaluate welding procedure information to specific standards

WELD 295 Independent Studies in Welding

Units: 1 - 3
Prerequisite: None.
Catalog Date: January 1, 2021

WELD 298 Work Experience in Welding

Units: 1 - 4
Hours: 60 - 300 hours LAB
Prerequisite: None.
Enrollment Limitation: Students must be in a paid or unpaid internship, volunteer position, or job related to the welding field with a cooperating site supervisor. Students are advised to consult with the Welding Department faculty to review specific certificate and degree work experience requirements.
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
General Education: AA/AS Area III(b)
Catalog Date: January 1, 2021

This course provides students with opportunities to develop marketable skills in preparation for employment or advancement within the welding field. It is designed for students interested in work experience and/or internships in associate degree level or certificate occupational programs. Course content includes understanding the application of education to the workforce, completion of Title 5 required forms which document the student's progress and hours spent at the work site, and developing workplace skills and competencies.

During the semester, the student is required to complete 75 hours of related paid work experience, or 60 hours of related unpaid work experience for one unit. An additional 75 or 60 hours of related work experience is required for each additional unit. All students are required to attend the first class meeting, a mid-semester meeting, and a final meeting. Additionally, students who have not already successfully completed a Work Experience course will be required to attend weekly orientations while returning participants may meet individually with the instructor as needed. Students may take up to 16 units total across all Work Experience course offerings. This course may be taken up to four times when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate mastery of specific job skills in the welding field related to an associate degree or certificate occupational program level career as written in the minimum three (3) learning objectives created by the student and his/her employer or work site supervisor at the start of the course.
- make effective decisions, use workforce information, and manage his/her personal career plans.
- behave professionally, ethically, and legally at work, consistent with applicable laws, regulations, and organizational norms.
- behave responsibly at work, exhibiting initiative and self-management in situations where it is needed.
- develop effective leadership styles at work, with consideration to group dynamics, team and individual decision making, and workforce diversity.
- communicate in oral, written, and other formats, as needed, in a variety of contexts at work.
- locate, organize, evaluate, and reference information at work.
- demonstrate originality and inventiveness at work by combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities using critical and creative thinking skills such as logical reasoning, analytical thinking, and problem-solving.

WELD 299 Experimental Offering in Welding

Units: 0.5 - 4
Prerequisite: None.
Catalog Date: January 1, 2021

WELD 300 Introduction to Welding

Units: 3
Hours: 36 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: CSU
Catalog Date: January 1, 2021

This course is an introduction to welding processes, including shielded metal arc, gas metal arc, flux-cored gas shield and self shield, gas tungsten arc, oxyacetylene cutting and welding on joint designs, and positions used in industry. Safety in arc welding, oxyacetylene, and plasma cutting is also covered. Field trips may be required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- apply safety standards to each welding process.
- demonstrate proper welding techniques for each welding process.
- evaluate welding projects in accordance with D1.1 Structural Welding Code-Steel Welding Procedures and Specifications.
- analyze welding projects and make corrective changes to meet industry standards.
- perform skills in arc welding that meet industry standards.

WELD 302 Introduction to Welding Metallurgy

Units: 3
Hours: 36 hours LEC; 54 hours LAB
Prerequisite: None.
Corequisite: WELD 300
Transferable: CSU
Catalog Date: January 1, 2021

This course provides a general overview of basic metallurgy of ferrous and non-ferrous metals. Topics include various steel making processes, different types of furnaces, identifying types of steels, and their mechanical, physical, chemical, and electrical properties. Crystal structures of metals, the iron equilibrium diagram, the periodic table of elements emphasizing those elements associated with steels, metallurgical failure of welds, steel deformation, and heat treatment of steels are also covered. In addition, material hardness using different hardness testing methods, calculation of different steel strengths and stresses, and impact tests using the Charpy and Izod methods are covered. Field trips may be required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe practical applications of metallurgy
- classify various steel making processes
- evaluate how steel is formed into various shapes and products
- evaluate the different types of iron and steel alloy
- describe the mechanical and physical properties of metal
- describe the basic metallurgical concept of iron, steel, and cast iron
- use the iron carbon equilibrium diagram to explain phase changes of iron and steel
- explain the micro structural analyses of steel
- explain heat treating and quenching
- explain annealing and normalizing
- explain isothermal transformation diagrams
- explain tempering
- explain metallurgical and chemical terminology
- explain how temperature affects distortion
- evaluate different types of material strengths
- compare steel hardness using different hardness testing methods
- explain surface hardening
- analyze Charpy Vee and Izod tests

WELD 316 Welding Inspection

Units: 2
Hours: 36 hours LEC
Prerequisite: WELD 300 with a grade of "C" or better; OR at least one year of welding experience.
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable: CSU
Catalog Date: January 1, 2021

This course covers the welding requirements for any type of welded structure made from commonly used carbon and low-alloy steel construction. Topics include welding construction industry, rules, regulations, and the principles, requirements, and methods of inspection. It covers weld measurements and discontinuities for evaluation acceptance using a variety of tools. It also emphasizes the lines of communication between the plant managers, welders, welding engineers, design/project engineers, welding foreman/supervisors, shop or field superintendents, and reporting supervisors. This course offers preparation for the Certified Welding Inspector Examination given by the American Welding Society.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- explain the scope and limitations of the Structural Welding Code (D1.1).
- explain safe practices for welding inspectors.

- analyze the requirements for a pre-qualified welding procedure.
- describe the qualification requirements of welding procedures and welding personnel, such as welders, welding operators, and tack welders, necessary to perform code work.
- explain the requirements for the preparation, assembly, and workmanship of welded steel structures to personnel.
- examine the qualification and responsibilities of inspectors, acceptance criteria for production welds, and standard procedures for performing visual inspection.
- explain the metal joining and cutting processes used in manufacturing.
- evaluate weld and base metal discontinuities.
- explain the mechanical and chemical properties of metals.
- interpret the requirements for the design of welded connections.
- interpret weld-joint geometry and weld-symbol dimensioning.
- explain the welding metallurgy of commonly used materials.
- demonstrate effective communication skills in the work place.

WELD 320 Shielded Metal Arc Welding – Structural

Units:	3
Hours:	36 hours LEC; 54 hours LAB
Prerequisite:	WELD 300 with a grade of "C" or better; OR at least one year of welding experience.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU
Catalog Date:	January 1, 2021

This course covers employment training for welding technicians. It emphasizes developing manipulative proficiency in the use of Shielded Metal Arc Welding (SMAW) in the horizontal (2F-2G), vertical (3F-3G), and overhead (4F-4G) positions on steel. It also covers filler metal classifications, welding power supplies, and welding safety. Welding test plates in accordance with the requirements to AWS D1.1 Structural Welding Code and AWS D1.5 Bridge Code are also covered.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate welding skills on joint designs and positions used in industry.
- explain arc blow, what causes it, and how to control it.
- explain the characteristics of the four filler metal groups for steel.
- define arc length, and describe the effects of using an improper arc length.
- explain and define the three units used to measure welding current.
- define open circuit voltage and operating voltage.
- analyze a welding machine duty cycle chart and explain its significance.
- describe the effects of the welding essential variables by comparing the bead's shape for weld width, reinforcement height, and appearance.
- evaluate a weld according to a given standard or code.
- analyze welding procedures used in manufacturing for production welding.
- describe the use of destructive and nondestructive testing for weld testing.

WELD 322 Shielded Metal Arc Welding (Pipe)

Units:	3
Hours:	36 hours LEC; 54 hours LAB
Prerequisite:	WELD 320 with a grade of "C" or better; OR a minimum of 2 years of welding experience.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU
Catalog Date:	January 1, 2021

This course covers the applications of shielded metal arc welding used to join low-pressure piping systems that carry water and residential natural gas. Topics include: welding required for high pressure critical piping systems such as steam pipe, fuel transportation pipe lines, boilers, offshore oil-rigs, and other critical heavy-duty piping systems.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- explain the code used for structural, refinery, and fuel transport piping systems.
- describe the system for depicting welding on a pipe print.
- distinguish between pipe and tubing.
- distinguish the different weld passes on pipe and explain the purpose of each one.
- inspect and evaluate welds on pipe according code standards.
- describe the four pipe positions.
- identify the pipe positions to qualify welders for all positions of pipe welding.

WELD 330 Gas Tungsten Arc Welding (Plate)

Units:	3
Hours:	36 hours LEC; 54 hours LAB
Prerequisite:	WELD 300 with a grade of "C" or better; OR at least one year of welding experience.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU
Catalog Date:	January 1, 2021

This course covers Gas Tungsten Arc Welding (GTAW) of aluminum, stainless steel, carbon steel, and other metals used in industry. This course content is relevant to code welding in accordance to the American Society of Mechanical Engineers Section 1X (ASME), the Structural welding Code D1.1 (AWS), and the American Petroleum Institute 1104 (API). It also covers filler metal selection, both specifications and classifications, shielding gases, welding power supplies, and welding safety. Certification and procedure qualification to code specifications are also covered.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify the variables that must be considered when setting up the components of the GTAW system.
- demonstrate safety precautions regarding electrical current, inert gases, the welding environment, and other areas of concern, such as hot work and ventilation.
- explain equipment components and accessories.
- analyze the factors of current type, amperage ranges, duty cycle, and adequate control during the welding operation to determine the selection of a power supply for welding.
- identify and explain functions of shielding gases in the GTAW system.
- design a welding procedure using GTAW for the root pass, fill passes, and cover passes.
- interpret the factors that determine the selection of filler materials.
- evaluate each weld by using the visual inspection method for defects according to the ASME, the AWS, and the API 1104 standards.

WELD 332 Gas Tungsten Arc Welding (Pipe)

Units:	3
Hours:	36 hours LEC; 54 hours LAB
Prerequisite:	WELD 330 with a grade of "C" or better; WELD 330 with a grade of "C" or better, OR a minimum of two years of welding experience.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU
Catalog Date:	January 1, 2021

This course covers the application of low-pressure and high-pressure critical piping systems used in oil, gas, nuclear, and chemical industries. It covers Gas Tungsten Arc Welding (GTAW) of aluminum pipe, stainless steel pipe, and carbon steel pipe. It explores code welding in accordance to the American Society of Mechanical Engineers Section 1X (ASME), Structural Welding Code D1.1 (AWS), and American Petroleum Institute 1104 (API). Certification and procedure qualification to ASME Section 1X, AWS D1.1, API 1104 code specifications are also covered.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe joint design and joint preparation
- analyze and interpret the most common root defects and the causes for each one
- evaluate the use of a hot pass
- explain reasons for purging pipe weld areas and describe the criteria for selecting gases used for purging
- describe the different types of purging dams
- explain root purging operation and oxygen level test
- perform tack welding procedures
- perform torch manipulation and welding techniques used for welding pipe
- examine and evaluate welded pipe according to AWS, ASME and API standards.
- explain how to make a single V-groove weld on pipe in any position
- identify areas to be inspected when performing GTAW pipe operations
- identify and describe types of weld integrity test performed on a welded pipe

WELD 333 Gas Metal Arc Welding, Steel

Units:	3
Hours:	36 hours LEC; 54 hours LAB
Prerequisite:	WELD 300 with a of "C" or better, or a minimum of one year of welding experience.
Transferable:	CSU
Catalog Date:	January 1, 2021

This course is the study of welding using the Gas Metal Arc Welding (GMAW) process on carbon steels in accordance with the American Welding Society (AWS), Structural welding Code D1.1, and Sheet Steel Code D1.3. It covers semi-automatic wire-feed welding with micro wires on steel plates of varying thicknesses. It also covers joint design and all welding positions, welding power supplies, types of metal transfer (spray, globular, pulsed-arc, and short circuit), filler metal selection, both specifications and classifications, shielding gases used for each type of transfer, and welding safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe how to use Gas Metal Arc Welding (GMAW) safely
- analyze and interpret the defects that may be caused when welding with the GMAW process
- explain the various types of metal transfer
- analyze problems that may occur when welding with the constant voltage welding machine
- describe the five essential variables that can be used to control the molten weld pool
- list shielding gases used for short-circuiting, spray, and pulse-spray transfer
- interpret how the molten weld pool can be controlled by varying the shielding gas, power setting, and weave pattern
- explain voltage, amperage, and electrical current as related to GMA welding
- evaluate completed welds to code specifications

WELD 334 Gas Metal Arc Welding: Ferrous and Non-Ferrous Metals

Units:	2
Hours:	18 hours LEC; 54 hours LAB
Prerequisite:	WELD 333 with a grade of "C" or better
Advisory:	ENGWR 102 and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" or better.
Transferable:	CSU
Catalog Date:	January 1, 2021

This course covers semiautomatic wire feed welding using micro wires on aluminum and stainless steel plate of varying thickness. Joint design, gas variations and all welding positions are covered. The emphasis of this course is on

code welding aluminum and stainless steels. The content of this course is relevant to code welding in accordance to the American Welding Society (AWS), Structural Aluminum Welding Code D1.2 and Structural Welding Stainless Steel Code D1.6. It also covers welding power supplies, types of metal transfer (spray, globular, pulsed-arc, and short circuit). This course also covers filler metal selection, both specifications and classifications, and shielding gases used for each type of transfer. Welding safety is also covered.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe safe procedures when using Gas Metal Arc Welding (GMAW) equipment
- explain the procedure in setting up constant potential or constant voltage power supplies when welding aluminum and stainless steel
- describe the shielding gases and electrode classifications when welding aluminum and stainless steel
- demonstrate welding techniques made on groove and fillet welds using various modes of metal transfer
- explain the significance of the filler metal prefixes
- interpret the standard filler metal numbering system for aluminum and stainless steel
- analyze the cause of corrosion in stainless steel welds
- explain the types of weld heat-affected zones
- describe the effects of preheating and post heating on stainless steel and aluminum
- explain the precautions that must be taken when welding stainless steel and aluminum alloys
- evaluate welds beads made with various shielding gas mixtures

WELD 335 Flux Core Arc Welding

Units: 3
Hours: 36 hours LEC; 54 hours LAB
Prerequisite: WELD 300 with a grade of "C" or better, or a minimum of one year of welding experience.
Transferable: CSU
Catalog Date: January 1, 2021

This course provides training to develop semi-automatic welding skills on carbon steels. Topics include small and large diameter flux cored electrodes, with and without external shielding gas, in all positions on fillet and groove welds. It also provides a thorough technical understanding of the Flux Core Arc Welding process and arc welding safety.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- explain the semi-automatic Flux Core Arc Welding (FCAW) process.
- analyze and interpret the most common weld defects and the causes for each one.
- recognize basic welding symbols and the different weld types and proper placement.
- determine when and why a backing bar and or back gouging is used in structural steel welding.
- examine and evaluate welds for certification and fabrication requirements in accordance to the American Welding Society (AWS) D1.1 Structural Steel Code.

WELD 342 Symbol Reading, Layout and Fabrication

Units: 3
Hours: 36 hours LEC; 54 hours LAB
Prerequisite: None.
Corequisite: WELD 300
Transferable: CSU
Catalog Date: January 1, 2021

This course covers blueprint and welding symbol interpretation. It includes metal layout, measurement, marking, and layout tools used in construction, and techniques of fabrication and assembly methods. It also covers fundamentals of blueprint reading, including basic lines and views, dimensions, notes and specifications, structural shapes, sections, detail, and assembly.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- interpret working sketches and prints common to metal fabrication
- analyze concepts and sketching techniques on structural shapes commonly used by welders
- examine and interpret weld symbols that are represented on drawings
- locate notes and specifications concerning important details on drawings
- interpret views on drawings with conventional breaks
- draw oblique and isometric sketches from orthographic views
- convert measurements from metric to standard

WELD 495 Independent Studies in Welding

Units: 1 - 3
Prerequisite: None.
Transferable: CSU
Catalog Date: January 1, 2021

WELD 499 Experimental Offering in Welding

Units: 0.5 - 4
Prerequisite: None.
Transferable: CSU
Catalog Date: January 1, 2021

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