



PROGRAM NAME

Welding Technology

DEVELOPING COLLEGE

Missoula College University of Montana

CREDENTIAL/TOTAL CREDIT HOURS

The welding program at Missoula College can be completed for the award of an NCCER credential, a C.T.S., or an A.A.S.

Completion of the first year of the welding program, 37 credits, qualifies students for the award of a Certificate of Applied Science. Completion of the first and second year of the welding program, 67 credits, qualifies students for the award of a Associate of Applied Science degree.

During Welding 180 (fall year 1) and Welding 280 (fall year 2) students have the opportunity to receive an industry recognized NCCER credential.

OVERVIEW AND PURPOSE

The mission of the Welding Technology Program is to provide the regional workforce with credentialed, skilled, and competent welders and to be responsive to emerging workforce needs. The Welding Technology Program prepares students to operate and troubleshoot a variety of welding power sources and related equipment. The program prepares students to solve problems found within the welding industry using computational skills and other problem-solving techniques essential to welding and steel fabrication. It also encourages the development of teamwork and interpersonal skills required on the job.

Welding students develop skills in six different welding processes—oxyacetylene (OAW), shielded metal arc (SMAW), gas metal arc (GMAW), flux core arc, (FCAW), submerged arc (SAW), and gas tungsten arc welding (GTAW). Beyond the development of welding skills and understanding of the process, they also study other skills, such as blueprint reading and layout, metallurgy, and gain an understanding of how heating and cooling cycles affect the properties of metals. Students also study the design of jigs and fixtures and how to incorporate these into an automated welding system.

The Welding Technology Program also has courses that provide for a solid background in the metals industry. Such courses are Computer Aided Design and Drafting (CADD), OSHA Rules and Compliance, and Related Metals Processes. Fabrication basics and Metal Design and



Construction utilize all of the gained knowledge with an instructor approved/student designed project.

CURRICULUM

Core Courses

- Introduction to Computers
- Interpersonal Skills in the Workplace
- Technical Mathematics
- Related Metals Process II
- Blueprint Reading and Welding Symbols
- Fabrication Basics
- Welding Layout Techniques
- Shielded Metal Arc Welding
- OSHA Rules and Regulations
- Flux Core Arc Welding
- Applied Metallurgy
- Introduction to Technical Writing
- Front Line Supervision
- Introduction to CAD
- Advanced Related Metals Processes
- Pipe Welding – Integrated Lab
- GTAW (integrated lab)
- Metal Fab Design/Construction
- Gas Metal Arc Welding
- Weld Testing Certification
- Automation in Welding

ENTRANCE REQUIREMENTS

None

COMPLETION REQUIREMENTS

Students must earn a grade of “C-” (70%; 2.0 GPA) or better in all required courses.



RANGE OF OCCUPATIONS

- Welding technician in:
 - Fabrication and manufacturing
 - Steel construction
 - Mining
 - Energy
 - Petroleum
 - Bridge construction
 - Other production areas

COURSE-LEVEL LEARNING OUTCOMES: CORE COURSES

Introduction to Computers

1. Define and explain basic microcomputer hardware and software terminology.
2. Describe and select strategies for purchasing a microcomputer system.
3. Proficiently operating a graphical user interface (GUI); and operate a mouse.
4. Describe and use basic operating features of Windows Desktop Accessories (Calculator, WordPad, Paint); use Windows Explorer or My Computer for file management tasks including creating folders/directories, deleting/moving/copying files, and backing up files, or use System Tools for Backup purposes.
5. Describe and use basic operating features of a popular integrated software suite to accurately and attractively create basic business correspondence with a word processing application to edit, format and manipulate text; a spreadsheet application to calculate, format and chart numbers; a database application to organize information for searching, sorting and selecting data; and a graphical presentation application to present information to a group of people.
6. Demonstrate correct keyboarding technique and ergonomics while using keyboarding tutorial and producing assigned documents.
7. Independently proofread and apply universal proofreading marks to make necessary additions to business documents.
8. Send and receive e-mail with attachments to/from instructor and other students.
9. Select a browser and apply research strategies to competently search the World Wide Web for assigned information.
10. Describe and apply ethical guidelines to e-mail communication, to security of computer hardware and software, and to privacy issues of computer data.
11. Illustrate and apply appropriate copyright citation to electronic and textbook references.
12. Troubleshoot and correct basic hardware/software malfunctions, such as printing errors and network errors.
13. Appraise advantages and disadvantages in new technologies such as wire and wireless communication, networking and sharing resources, and multimedia devices.



Interpersonal Skills in Workplace

1. Understand the principal concepts of communications focused on expressive verbal, non-verbal, and listening skills.
2. Recognize, understand and appreciate the inherent difficulties and barriers to productive communications and work relations.
3. Develop skills and productive approaches to communications, conflict, decision and agreement.

Technical Mathematics

1. Utilize and apply mathematical operations, measurement (English and Metric Systems), introductory geometric principles and applied algebra into technical applications in academic and workplace situations
2. Read, interpret, and produce solutions to applications at the introductory technical mathematics level
3. Apply ratio and proportion concepts to introductory technical mathematics situations
4. Apply appropriate technology in a mathematical situation
5. Determine the validity of results and data
6. Solve any component of a right triangle with any two components given

Related Metals Processes II

1. Identify types of fasteners and their application.
2. Cut internal and external threads using taps and dies.
3. Use precision measuring instruments.
4. Setup and use basic layout tools.
5. Sharpen drills, and lathe tools.
6. Setup and operate band saw, drill press, metal lathe, and milling machine.
7. Calculate speeds and feeds for machining.
8. Use clamping and other holding devices.

Blueprint Reading & Welding Symbols

1. Recognize shape description through graphic representation.
2. Layout and represent objects graphically according to accepted drafting standards.
3. Calculate material weights, lengths, hole placement, part placement, etc., mathematically from information given on industrial blueprints.
4. Identify and understand material specifications.
5. Recognize and interpret welding symbol

Fabrication Basics

1. Demonstrate, by written exam, the theory and safe operation of equipment.
2. Demonstrate, by practical exam, making a project from a blueprint to a finished product.

Welding Layout Techniques

1. Develop an understanding of techniques used in industry for layout of sheet, plate, and pipe.



2. Familiarize with the tools utilized in layout of sheet, structural shapes, plate, and pipe.
3. Calculate material weights, lengths, hole placement, part placement, etc., mathematically from information given on industrial blueprints.
4. Demonstrate the use of these layout techniques, calculations, and use of tools through the completion of numerous practical exams achieving aggregate scores of 70% or better.

Shielded Metal Arc Welding

1. Demonstrate by written exam, the theory and safe operation of SMAW equipment.
2. Demonstrate by written exam the theory and safe operation of Oxy-Fuel Cutting (OAC), Plasma Arc Cutting (PAC) and Air Carbon Arc Cutting (AAC).
3. Demonstrate by practical exam, evaluated to AWS Structural Welding Code-Steel (AWS D1.1) standards, skill in the use of SMAW equipment and materials.
4. Demonstrate by practical exam, evaluated to AWS Structural Welding Code-Steel (AWS D1.1) standards, skill in the use of OAC, PAC, AAC equipment and materials.
5. Demonstrate by practical exam, evaluated to industry standards, skill in the use of OAW equipment and materials.

OSHA Rules and Regulations Welding

1. Understand the purpose and scope of the Occupational Safety and Health Act (OSHA).
2. Recognize occupational health and safety situations and understand their power to correct them.

Flux Core Arc Welding

1. Demonstrate, by written exam, the theory and safe operation of FCAW equipment.
2. Demonstrate, by practical exam evaluated to AWS Structural Welding Code-Steel (AWS D1.1) standards, skill in the use of FCAW equipment and materials.

Applied Metallurgy

1. Demonstrate by written exam the various techniques of steel manufacture, processing and finishing.
2. Demonstrate by written exam the ability to identify various metals and the manner in which industry classifies them, along with their properties and use.
3. Demonstrate by written exam the ability to identify phase changes in ferrous metals along with their properties and use.
4. Demonstrate by written exam the ability to identify and select proper base and filler metals.
5. Demonstrate by written exam the ability to identify metallurgical problems associated with welding and how to avoid these problems.
6. Demonstrate by written exam the ability to identify welding procedures for low, medium and high carbon steels, alloys steels and cast iron.

Intro to Technical Writing

1. Introduction to constructed text that accurately communicates technical information using technical text, document design, graphic placement, and technical formats.



2. An awareness of both academic and technical writing genres and how the writing situation shapes the document.
3. Introduction to a writing process that includes revision and editing.
4. Introduction to *The Little, Brown Compact Handbook* as a tool to gain control of punctuation, grammar, syntax, and spelling.

Front Line Supervision

1. Develop the ability to integrate the proven, traditional, and functional approach to supervisory management, and apply it to today's knowledge-based and multicultural workforce.
2. Demonstrate the ability to effectively communicate on a professional level with workers, unions, and other management personnel including: leading, motivating, coaching, appraising, disciplining, and problem solving.
3. Develop the ability to analyze problem situations, and suggest possible solutions.
4. Acquire and demonstrate an understanding of management thought including functional relationships and various management theories.

Introduction to CAD

1. Apply basic CAD commands to draw and edit a simple, 2D object
2. Demonstrate file management skills such as saving a drawing and copying it to portable storage
3. Create a template drawing with basic drawing settings
4. Draw a CAD drawing to scale
5. Annotate a CAD drawing
6. Print a CAD drawing to scale

Advanced Related Metals Processes

1. Produce precision layout and fixtures.
2. Produce precision layout and fixtures.
3. Bore on a lathe.
4. Simple and direct index on a mill.
5. Produce a variety of fits and clearances.
6. Inspect and maintain machine tool equipment.
7. Perform basic Setup, Programming, & Operation on a CNC Turning Center Lathe.
8. Perform basic Setup, Programming, & Operation on a CNC Vertical Milling Center.

Pipe Welding – Integrated Lab

- 1.

GTAW (integrated lab) – Gas Tungsten Arc Welding

1. Complete a safety test covering GTAW safe operation with a score of 70% or better.
2. Identify and describe fully each control on an industrial rated/type GTAW power source.
3. Demonstrate the proper assembly of a GTAW torch and related equipment.



4. Demonstrate machine set-up for the successful welding of aluminum, stainless steel and carbon steel.
5. Demonstrate fillet and groove welding of aluminum, stainless steel, carbon steel and identify deficiency based to American Welding Society standards.
6. Inspect fillet and groove welds on aluminum, stainless steel, carbon steel and identify deficiency based upon American Welding Society standards.
7. Use technical terminology as it relates to welding based upon American Welding Society terms and definitions.
8. Complete written exams given, covering the theory of operation of GTAW with accumulative scores of 70% or better.
9. Complete practical welding exams given covering the welding of aluminum, stainless steel, and carbon steel using fillet and groove welds in the flat, horizontal and vertical positions based upon acceptable standards given by AWS.

Metal Fab Design/Construction

1. Use technical terminology as it relates to welding based upon American Welding Society terms and definitions.
2. Demonstrate machine set-up for the successful welding of aluminum, stainless steel, carbon steel.
3. Demonstrate machine tool set-up/operation...press brake, optical tracer torch, lathe, milling machine, CNC mill, CNC lathe, and CNC plasma table, various welding machines for the successful forming, machining & welding of metals.
4. Demonstrate fillet and groove welding to American Welding Society standards.
5. Complete written exams given covering metal fabrication with accumulative scores of 70% or better.

Gas Metal Arc Welding

1. Develop skill through safe operation of Gas Metal Arc welding equipment
2. Develop comprehension of the technical aspects of GMAW, terms, concepts, and equipment
3. Develop skill in the preparation and welding of coupons and assemblies with GMAW
4. Develop an awareness of skill in working to industry quality standards

Weld Testing Certification

1. Interpret welding codes and their use
2. Develop welding skills for certification
3. Understand procedure and performance welding qualification

Automation in Welding

1. Develop an awareness of the advantages / disadvantages of automation
2. Develop an awareness of available equipment used in welding automation
3. Develop an understanding of how to automate the welding process
4. Develop an understanding of safe operation of the various equipment used