

COURSE OUTLINE **Cutting Operations**

Course Description

WE 113. Cutting Operations. 2 hours credit. Prerequisite: A score at a pre-determined level in reading, writing, and math on a diagnostic instrument selected by the department. This course will enable the student to recognize and apply proper fundamentals of various cutting processes. The student will learn theory and will practice modern cutting methods, including oxyacetylene cutting, plasma cutting, carbon arc cutting, and shape cutting. Cutting safety will be emphasized.

Course Relevance

The principles learned in this course will allow the student to understand how proper fundamental skills and proper analysis in cutting operations will help prepare them for a position in a career of welding.

Required Materials

Althouse, A.D. (2004). *Modern welding*. Tinley Park, IL: Goodheart-Wilcox Company, Inc.

Learning Outcomes

The intention is for the student to be able to

1. Demonstrate safety in cutting primarily through shop exercises
2. Demonstrate basic oxyacetylene, plasma, and carbon arc cutting skills and techniques primarily through shop exercises
3. Explain the fundamental theories of the various cutting operations covered through written and/or classroom exercises

Primary Learning PACT Skills that will be DEVELOPED and/or documented in this course

Through the student's involvement in this course, he/she will develop his/her ability in the following primary PACT skill areas:

1. Critical Thinking
 - Through the analysis of proper cutting fundamentals, the student will recognize and understand the role these fundamentals play in obtaining a quality cut
2. Problem Solving
 - Through the analysis of various cutting processes, the student will be able to identify strengths and/or limitations of each individual process and make decisions based on that knowledge
3. Field-Related Technology
 - Through the use of current industry standards and technology, the student will be able to perform cutting operations with a high level of proficiency

Secondary skills (developed but not documented):

Health Management

Reading

Major Summative Assessment Task(s)

These learning outcomes and the primary Learning PACT skills will be demonstrated by

1. Performing skill in cutting, using various operations and proper equipment to obtain a quality cut.

Course Content

- I. Themes – Key recurring concepts that run throughout this course:
 - A. Safety and quality
- II. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
 - A. The impact of proper cutting fundamentals in relation to a quality cutting operation
 - B. The effect of heat and plasma in relation to the various metals
- III. Concepts – Key concepts that must be understood to address the issues:
 - A. Heat selection
 - B. Process analysis
 - C. Flame analysis
 - D. Terminology
- IV. Skills/Competencies – Actions that are essential to achieve the course outcomes:
 - A. Demonstrate the ability to perform and know all major components of the Carbon-Arc Gouging process
 - B. Demonstrate the ability to perform and know all major components of the Plasma-Arc Cutting process
 - C. Demonstrate the ability to perform and know all major components of the Oxy-Fuel Cutting process
 - D. Demonstrate an understanding of set-up and operation of various shape cutting procedures

Learning Units

- I. Safety in the welding shop
 - A. Accidents
 - B. General shop safety
 - C. Safety in the welding environment
 - D. Oxy-fuel Gas Welding and cutting safety
 - E. Arc Welding and cutting safety
 - F. Resistance welding safety
 - G. Safety around welding robots
 - H. Special welding process safety
- II. Plasma Arc cutting
 - A. Plasma Arc cutting principles

- B. Plasma Arc cutting equipment and supplies
 - C. Plasma and shielding gases
 - D. Setting up the PC station
 - E. Safety equipment
 - F. Preparing to cut
 - G. Cutting procedure
 - H. Cutting quality
 - I. Plasma Arc gouging
 - J. Shutting down the PAC station
- III. Arc and Oxygen Arc cutting equipment and processes
- A. Air Carbon Arc Cutting (CAC-A) equipment
 - B. Air Carbon Arc Cutting and gouging
 - C. Exothermic cutting equipment and supplies
 - D. Exothermic cutting, gouging, and piercing
 - E. Oxygen Arc Cutting (OAC) equipment
 - F. Oxygen Arc Cutting and gouging
 - G. Shielded Metal Arc Cutting (SMAC) electrodes
 - H. Shielded Metal Arc Cutting and gouging
 - I. Gas Metal Arc (GMAC) and Gas Tungsten Arc (GTAC) Cutting principles
 - J. Carbon Arc Cutting (CAC) and gouging equipment
 - K. Carbon Arc Cutting and gouging
- IV. Oxy-fuel Gas Cutting equipment and supplies
- A. Complete portable oxy-fuel gas cutting outfit
 - B. The cylinder truck
 - C. Regulators of oxy-fuel gas cutting
 - D. The cutting torch
 - E. Torch guides
 - F. Multiple torches
- V. Oxy-fuel Gas cutting
- A. The heat combustion of steel
 - B. Oxy-fuel Gas Cutting process
 - C. Cutting outfit
 - D. Cutting torch
 - E. Using a cutting torch
 - F. Cutting steel with the oxy-fuel gas cutting torch
 - G. Cutting ferrous alloy metals
 - H. Cutting cast iron
 - I. Automatic cutting
- VI. Special cutting processes
- A. Oxygen Lance Cutting (OLC)
 - B. Oxy-fuel Gas Cutting (OFC) underwater
 - C. Oxygen Arc Underwater Cutting (OAC)

- D. Metal Powder Cutting (OC-P)
- E. Chemical Flux Cutting (OC-F)
- F. Laser Beam Cutting (LBC)
- G. Water Jet Cutting

Learning Activities

Learning activities will be hands on exercises in both booth and shop. Classroom lecture is designed to enable the student to understand the key principles in process analysis, cutting fundamentals, and correct use of associated equipment.

Grade Determination

The student will be graded on completion of assessment tasks (learning activities), adequate participation (discussion) and the final project.