#158

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: Advanced Welding Processes and Fabrication (Theory & Practical)

e No.: MET125--15(PRACTICAL)

Program: WeldincI and Fabrication

Semester: Two

Date: AUGUST 1988

Author: Gunter Thorn

New Revision: xx

•PROVED: Chairperson Date / /

Advanced Welding Processes & Fabrication MET125-15

Course Name **Course Number**

PHILOSOPHY/GOALS:

With Fundamentals of Arc and Gas Welding as a pre-requisite, this course continues to develop the welding ability of the student and increases his/her knowledge of weldability of metals, welding processes and fabrication skills. The program meets all requirements to be considered a pre-apprenticeship course.

METHODS OF ASSESSMENT (GRADING METHOD):

a) Pre-requisite: Fundamentals of Arc and Gas Welding
b) Sault College Policy/Procedure No. l-G-6
c) Computer Marked tests - 70% Minimum
d) Overal Grading - Practical - 40%
Theory - 40%
Attendance/Safety/Attitude - 20%

A+ = 95 - 100%
A = 85 - 94%
B = 75 - 84%
C = 60 - 74%

TEXTBOOK(S):

MODULES: MFE - Advanced Arc Welding
MFJ - Gas Tungsen Arc Welding
MFI - Air Carbon Arc Gouging and Cutting
MFF - Gas Metal and Flux Core Arc Welding

OBJECTIVES;

The objective of this course is to prepare the student for the welding industry, to be a safe and competent employee in any phase of the welding industry- The student will be required to pass all position Canadian Welding Bureau and Boiler and Pressure Vessel Tests.

MODULE: MFE - ADVANCED ARC WELDING

1} 1) Concepts of Basic Electricity.

2) Concepts of Transformers, Alternating Current and Rectifiers.

3) General Requirements for Arc Welding, Duty Cycle and Open Circuit Voltage.

2) 1) Shielded Metal Arc Basics.

2) Manufacture of Electrodes.

3) Functions of Electrode Coatings.

4) Unit Pre-Test.

5) Theory Test #1.

UNIT	LEARNING TASK
3)	1) Overhead Fillets 4-F Position; Stringer Beads E6010
	2) Overhead Fillets 4-F Position; Stringer Beads E6011
	3) Overhead Fillets 4-F Position; Stringer Beads E7018
	4) Simulated Overhead Groove Welds 4G Position Stringer Beads E6010
	5) Simulated Overhead Groove Welds 4G Position Stringer + Weave Beads E6010/E7018
4)	1) Horizontal Fillets on Pipe 2F Position E6010
	2) Horizontal Fillets on Pipe 2F Position E6011
	3) Horizontal Fillets on Pipe 2F Position E7018
	4} Horizontal Fillets on Structural Shapes 2F Position
	5) Horizontal Fillets on Round Bar 2F Position E7018
5)	1) Groove/Fillet Welds Pipe-to-Pipe

Pipe Axis - Horizontal
E6010

2) Groove/Fillet Welds
Pipe-to-Pipe
Pipe Axis - Horizontal
E6010/E7018

£	UNIT	LEARNING TASK
	6)	1) Fabricate a Line-up Jib
		2) Outside Corner Joints 1G Position - E6010
		3) Outside Corner Joints 2G Position - E6010/E7018
		4) Outside Corner Joints 3G Position - E6010
		5) Outside Corner Joints 4G Position - E6010/E7018
	7)	1) 1G Open Root Plate Test E6010/E7018
		2) 2G Open Root Plate Test E6010/E7018
		3) 3G Open Root Plate Test E6010/E7018
		4) 4G Open Root Plate Test E6010/E7018
	8)	1) IGF Plate Test with Backing
		2) 2GF Plate Test with Backing
		3) 3GF Plate Test with Backing
		4) 4GF Plat-** Toqf wit-h Racking
	9)	1) Specific Materials in Electrode Coatings*
		2) Electrode Classification.
		3) Characteristics of Covered Electrodes.
		4) Electrode Selection.

5) Electrode Storage,
6) Low Alloy Electrodes
7) Unit Pre-Test,
8) Theory Test # 2.

LEARNING TASK

1) Welding Cast Irons,
2) Welding with Stainless Steel,
3) Hardsurfacing Techniques.
4) Unit Pre-Test.
5) Theory Test #3.

MFJ - GAS TUNGSTEN ARC WELDING

1) Describe the Gas Tungsten Arc Welding Process.
2) Describe the Advantages and Disadvantages of GTAW.
3) Identify various terms by which GTAW is known.
4) Identify some of the industries that use this welding process extensively.

1) Identify all the protective clothing best suited to the TIG Process.
2) Determine the proper welding lense selection for TIG.
3) List electical safety checks to be made before welding
4) Identify ventilating problems associated with TIG.

1) Cyber-Wave 300S TIG Unit - Setup assembly, operating functions, shut-down procedures.
2) Constant Current Welding Machines, Transformer/Rectifi Units.
3) Polarity Relationships to GTAW - Polarity Heat Distributions.
4) Line Power Characteristics(Utility Power Supply to the Shop).
5) High Frequency use with GTAW.
6) Pulse Arc Mode.

7) Balanced Wave Function in GTAW.

8) H. F. Radiation (Radio Communication Interference).

9) Study of the Consol Panels of the CW300S

UNIT	LEARNING TASK
4)	Set-up a GTAW Station for Welding Mild Steel and Stainless Steel. Shut-Down GTAW Station.
5)	Gas Cooled (Air Cooled) and Wateir Cooled GTAW Torches. Torch Components and Cup Choices. Torch Hose Assembly - Light Duty. Torch Hose Assembly - Water Cooled (Heavy Duty) Torch Assembly for Welding. Light gauge M.S. Strip/Filler Wire Beads (Lap and T Joints).
6)	Purpose of the Shielding Gas in GTAW. Argon Gas Characteristics. Helium Gas Characteristics. Gas Mixes (with reactive gases). Recommended Gas Choices. Gas Influence on Weld Beads.
7)	Regulator Construction and Function. Flowmeter Construction and Function. Effective Gas Volume Coverages. Assembly of Regulator/Flowmeter Units. GTAW Light Gauge Lap Joint Welds(Mild Steel)
8)	1) Contactor Controls.

2) Remote Amperage Controls.

3) Connecting of contactor and Amperage Remote Controls.

4) Prepare M.S. Plate for Butt Welds - Bevel Machine Cuts

UNIT	LEARNING TASK
9)	1) Tungsten and Tungsten Alloyed Electrodes and the Colour Code.
	2) Electrode Care and End Preparation Methods.
	3) Electrode selection; Size - Alloy Type.
	4) GTAW of Mild Steel Butt Welds 1G.
	5) Practice Exercises in GTAW Mild Steel Butt Welds 1G.
10)	1) Study the Filler Wires used in TIG Welding Mild Steel
	2) Proper Handling and Storage of Mild Steel Filler Wire
	3) A Demonstration of TIG welding on Mild Steel.
	4) A Study of Joint Design and Joint Preparation Types.
	5) A Study of Mild Steel Weld Defects.
11)	1) A study of the correct Filler Rod Selection for some of the common Stainless Alloys and an Examination of the Stainless Alloy Coding System.
	2) Solar Flux, its purpose and use in TIG Welding Stainless Steels, and Gas Backing Techniques.
	3) Welding Procedures for Stainless Steel Alloys.
	4) Examining the Totally Enclosed Environment methods for Welding Stainless and other High Quality Metals.
	5) Stainless Steel Butt Weld Exercises. M.S. plate / S. S. filler.
	6) Post Cleaning Stainless Steels*

MODULE: MFI - AIR CARBON ARC GOUGING & CUTTING

1)	1) Describe the basic principles of how the Air Carbon Arc (AAC) process works and compare it to the oxy-fuel process.

2) Identify the advantages provided by the Air Carbon Arc metal removal process.

3) Identify some of the disadvantages of AAC cutting and gouging.

LEARNING TASK

1) Identify ten areas of industry that extensively use the Air Carbon Arc process and indicate some common practical uses employed in various construction and prepare industries•

2) OMIT

1) Study the areas of personal safety that are associated with the Air Carbon Arc cutting and gouging process.

2) Study ventilation needs, fire and electrical shock hazards associated with the Air Carbon Arc system.

1) Express in pounds per square inch (PSI) and cubic feet per minute (CFM) the air requirements to operate:
   - a light duty AAC torch
   - a standard industrial AAC torch capacities

2) OMIT

1) Study the power supplies recommended for AAC use and understand machine capacities in:
   - dity cycle, primary input, and nema classification and relate this information to AAC needs.

2) OMIT

1) Study the parts of an Air Carbon Arc hand torch and the combined air hose/cable lead and know the function of the components.

2) OMIT

1) Study the construction, copper clading, sizes and shapes of carbon electrodes.

2) Study the correct use and selection carbon electrodes designed for AC and DC application.

3) Study the socket joint type carbon electrodes and their use with semi and automatic equipment.

4) Study the care in storing and identifying of carbon electrodes.

8) 1) OMIT

2) OMIT

UNIT	LEARNING TASK
	3) Study the metallurgical affects of air carbon arc heat cycle and carborizing possibilities when using the AAC process.
0)	1) Study I.ho inolhodn of orirjn rind qrroovo prropnmUon or stainless steels and the limitations and advantages of some processes.
	2) Identify "chromium carbide precipitation" and how it can affect finished welded products.
10)	1) OMIT
	2) OMIT
11)	1) Study an air carbon arc station set up.
	2)a)Have the instructor explain assembly procedure, safety check out$_f$ electrode air pressure and amperage selections.
	b)Observe instructor's demonstration for electrode stickout, speed of travel, angle of rod to work piece, depth of groove, etc.
	c)Assemble materials for AAC gouging:
	1) 1/2" X 6" X 6" (scrap welded sample with existing welds) including T-Joints, cross-joints, pipe to plate, etc.
	2) one air carbon arc torch, heavy duty (class 1) welding machine and compressed air line supply.
	3) Arrange booth or shielded work area.
	4) Arrange standby fire equipment (extinguisher).
	d)Practice on flat gouging on items in c - 1. Do not attempt position gouging until you have a qualifying grade in flat work.
	3)a)Obtain a qualification in setting up and dismantling an AAC station.

b)l) Make 3/8" single pass grooves in the 1 G position using 1/4" round electrodes. (a minimum of size • 6 inch single passes).

UNIT	LEARNING TASK
	2) OMIT
	3) OMIT
	4) OMIT
12)	OMIT
13)	1) Study and follow the preventive maintenance procedure outline•
	2) Study and recognize the problems the operator can experience in air carbon arc use and how they can be resolved.

MODULE: MFF - GAS METAL & FLUX CORE ARC WELDING

1)	1) Identify all parts of the GMAW and FCAW Welding units
	2) Identify the sequence of assembling the equipment and testing and shutting down the equipment.
2)	1) Identify the types of wire used in GMAW and FCAW and the method used to classify them.
3)	1) Identify the various types of shielding gases used in GMAW and FCAW and the method of storage.
4)	1) Identify the type of welding machine used for GMAW and FCAW.
	2) Identify the type of wire feeder used and its function
5)	1) Weld GMAW stringer beads in the flat position.
	2) Weld FCAW stringer beads int he flat position.

TASK

1) Weld GMAW fillet welds in the flat position.
2) Weld FCAW fillet welds in the flat position.

1) Weld GMAW fillet welds in the horizontal position.
2) Weld FCAW fillet welds in the horizontal position.

1) Weld GMAW butt welds in the flat position.
2) Weld FCAW butt welds in the flat position.