

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: WELDING

CODE NO: IR_N 804

SEMESTER:

PROGRAM: IRONWORKER - ADVANCED

AUTHOR: D. S0CCHIA

DATE: aUNE 1993

PREVIOUS OUTLINE DATED:

APPROVED: '£ > ^ ^ " Q ~ ~ T
Dean, School of Technical Trades

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Date

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TOTAL CREDIT HOURS: 32 (8 x 4hrs)

PREREQUISITE(S): Ironworker apprenticeship plus the successful completion of the basic and intermediate levels of training.

I. PHILOSOPHY/GOALS:

To provide apprentices with a combination of theory and 'hands-on' training with the automatic, semi-automatic and non-traditional forms of welding. The short term goal is to assist the advanced apprentice in his / her efforts to pass the provincial C of Q Exam.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will:

- 1) Set up and operate typical semi-automatic arc welding equipment,
- 2) Understand the semi-automatic arc welding processes in terms of their unique 'constant voltage' characteristics.
- 3) Recognize and correct weld defects and discontinuities.
- 4) Be familiar with some of the non-traditional forms of welding.

III. TOPICS TO BE COVERED:

1. Course Introduction and Orientation.	4 Hr.
2. An Overview of the GMAW / FCAW Process and Equipment.	4
3. GMAW / FCAW Electrical Fundamentals	4
Review Assignment // 1.	Homework
Theory Test // 1. and Review	2
Shop Assignment	In Process
4. Non-traditional Welding Processes	12
Review Assignment // 2.	
Theory Test // 2. and Review	
Shop Assignment	In Process
5. Quality Assurance Testing	2

NOTE: The instructor reserves the right to modify and / or change course objectives and topics in order to better serve the needs of the class.

LEARNING ACTIVITIES

<u>TOPIC NO.</u>	<u>NUMBER OF PERIODS</u>	<u>GENERAL TOPIC DESCRIPTION</u>	<u>RESOURCES</u>
1	2T	INTRODUCTION and ORIENTATION	
	1.1	Describe and explain the following: a) course outline b) course guidelines c) course marking system d) attendance requirements e) personal safety and shop equipment f) general shop safety	Classroom Handouts
	1.2	Discuss / explain the potential uses, advantages and disadvantages of the GMAW / FCAW processes.	
	2S 1.3	Do a general tour of the welding shop to identify: a) exits b) welding stations c) lighting d) ventilation e) general tools and equipment.	K123 Shop
	1.4	Demonstrate a typical welding station set up for GMAW / FCAW to include: a) power unit and wire feeder b) drive rolls, liner, contact tip, gun and nozzle c) power unit characteristics and controls d) wire feeder characteristics and controls e) shielding gas, flow meter and purge system	
	1.5	Demonstrate general welding techniques for the GMAW and FCAW process to be employed during this course to include: a) setting wire speed (amperage) and voltage b) contact tip and nozzle adjustment c) visible stickout d) push technique and gun angle e) pull technique and gun angle f) welding with long visible stickout g) welding with short visible stickout h) globular vs spray transfer.	

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LEARNING ACTIVITIES

<u>TOPIC NO.</u>	<u>NUMBER OF PERIODS</u>	<u>GENERAL TOPIC DESCRIPTION</u>	<u>RESOURCES</u>
2		AN OVERVIEW of the GMAW / FCAW PROCESS and EQUIPMENT.	
	2T 2.1	List and briefly describe the various pieces of equipment required for the GMAW and FCAW process to include: a) power supply b) wire feeder c) shielding gas (s) d) flowmeter e) electrode	Classroom
	2.2	Identify and describe the three possible modes of transfer: a) short circuiting b) globular c) spray	
	2.3	Identify / list the conditions necessary for each mode of transfer to occur. a) wire size b) shielding gas c) current density	
	2.4	List common shielding gases for GMAW and FCAW.	
	2.5	Identify and briefly explain the CSA standards for GMAW / FCAW filler wires to include: a) common diameters b) electrode designations for mild steel.	
	2.6	Briefly explain the significance of correct shielding gas / electrode identification and selection in terms of: a) welding parameters b) weld penetration / profile c) mechanical properties.	
	2.7	List the normal parameters that must be identified and set by the welder. a) shielding gas and flow rate b) electrode diameter and designation c) polarity d) amperage / wire speed e) voltage f) electrical / visible stickout	

LEARNING ACTIVITIES

<u>TOPIC NO.</u>	<u>NUMBER OF PERIODS</u>	<u>GENERAL TOPIC DESCRIPTION</u>	<u>RESOURCES</u>
2S	2.8	Review and demonstrate a typical GMAW / FCAW station and set-up to verify the following: a) ventilation b) welding lense shade c) wire size and designation d) shielding gas mixture e) adequate purging f) setting weld parameters	K123 Shop
	2.9	Demonstrate the following basic exercises for student team* members: a) running beads with long, then short stickout. b) record data for each circumstance c) running beads with globular, then spray transfer. d) recording data for each circumstance e) pad exercise; globular transfer	
	2.10	Have students practice doing same in groups of at least two. *NOTE: Teams should consist "of at least two persons; one welding, one recording data; then switch roles.	
GMAW / FCAW ELECTRICAL FUNDAMENTALS			
2T	3.1	Briefly explain why the above processes are termed 'constant voltage'.	
	3.2	Briefly explain the purpose and significance of the following: a) pinch rolls b) liners c) contact tip d) nozzle e) electrical vs visible stickout	Classroom
	3.3	Briefly explain the effects of electrical and visible stickout on: a) weld parameters b) penetration c) build-up d) modes of transfer	
	3.4	Briefly explain the controlling factors for modes of transfer to include: a) voltage b) current density c) shielding gas	

LEARNING ACTIVITIES

<u>TOPIC ML.</u>	<u>NUMBER OF PERIODS</u>	<u>GENERAL TOPIC DESCRIPTION</u>	<u>RESOURCES</u>
	3 5	Briefly explain the source of fluxing and de-oxidization for the GMAW / FCAW processes.	
		Review Assignment # 1.	Handouts
2S	3.6	List the parameters for single and multiple pass fillet welds on 1/4 and 1/2 inch plate.	
	3.7	Make single pass fillet welds on 1/4 and 1/2 inch plates.	K1 ²³ Snop
	3.8	Produce multi-pass fillet welds on 1/2 inch plate.	
	3.9	Measure and check welds for size.	
	3.10	Inspect welds for possible defects and discontinuities.	
2T		THEORY TEST # 1 and REVIEW	
2S	3.11	List the parameters for multi-pass groove welds on 1/2 inch plate.	
	3.12	Demonstrate joint fit-up and tack welding procedures.	
	3.13	Produce multi-pass groove welds on 1G test assemblies c/w backing bars.	
	3.14	Measure and check welds for build-up.	
	3.15	Inspect welds for possible defects and discontinuities.	
		NON-TRADITIONAL WELDING PROCESSES	
2T	4.1	Discuss / explain the potential uses, advantages and disadvantages of the SAW process	
	4.2	Describe a typical SAW station to include: a) power unit and wire feeder b) drive rolls, liner, contact tip, gun, and nozzle. c) power unit characteristics and controls. d) wire feeder characteristics and controls. e) flux types. f) flux delivery systems.	
	4.3	Discuss and explain typical safety items and precautions.	

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<u>TOPIC NO,</u>	<u>NUMBER OF PERIODS</u>	<u>GENERAL TOPIC DESCRIPTION</u>	<u>RESOURCES</u>
2S	4.4	Students to practice welding on the previously demonstrated weld assemblies.	Shop
	4.5	Students to hand in the following welds at the end of the shop period: a) lap weld_____single pass b) groove weld_____multi pass.	
2T	4.6	Discuss / explain the potential uses, advantages and disadvantages of the THERMITE and FRICTION welding processes.	
	4.7	Describe a typical welding station for each of the above processes to include: a) unique characteristics b) equipment required c) quality of weld	Classroom
	4.8	Discuss and explain typical safety items and precautions.	
2S	4.9	Students to switch welding processes with other groups.	K123 Shop
	4.10	Provide groups with a demonstration of each process they have changed to.	
	4.11	List typical parameters for each process.	
	4.12	Students to practice single and multi-pass fillet and groove welds.	
2T	4.13	Discuss / explain the potential uses, advantages and disadvantages of the OXY-ACETYLENE welding and cutting process.	Classroom
	4.14	Describe a typical welding and cutting station for the above process to include: a) equipment required b) quality of weld c) quality of cut d) selection of tip sizes e) setting of pressures.	
	4.15	Discuss and explain typical safety items and precautions.	
		Review Assignment # 2	
2S	4.16	Students to practice welding on the previously demonstrated weld assemblies.	K123 Shop
	4.17	Students to hand in the following welds at the end of the shop period: a) lap weld_____single pass b) groove weld_____multi-pass	

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2T		THEORY TEST # 2 and REVIEW	
2S	4.18	Demonstrate the welding of standard check tests to include: a) lap weld c/w stop and re-start b) groove weld c/w stop and re-start	' . " c . M " b n o p
	4.19	Demonstrate the following destructive tests on prepared weld samples: a) root bend - lap weld b) root bend _____ groove weld _____ c/w standard 'nick-break' ¹ .	
	4.20	Inspect welds and describe criteria for acceptance according to CSA W47.1	

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EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS ETC.)

General Assessment	*Final Mark	
A = 85 - 100 %	Theory Tests	30
B = 75 - 84 %	Homework	10
C = 60 - 74 %	Practical	60
d = 50 - 59 %		
F = 0 - 49 %	Total	100 %

REQUIRED STUDENT RESOURCES

Welding Text
3 Pens - (1 blue, 1 black, 1 red)
Binder c/w paper
Welding Shield
Welding Gloves
Impact Resistant Safety Glasses
Regulation, CSA Work Boots.

SPECIAL NOTES

Attendance to all classes is mandatory and will be recorded on an hour by hour basis using the 'Record of Attendance' form.