



**I. COURSE DESCRIPTION:**

This curriculum has been designed to provide new and / or inexperienced clients with a combination of theoretical knowledge and practical (hands on) skill with the safe use and operation of OFG and SMAW welding and cutting and heating equipment

**II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:**

Upon successful completion of this course, the student will demonstrate the ability to:

**1. *Demonstrate a sound working knowledge of both personal and shop safety.*****Potential Elements of the Performance:**

- identify proper eye protection as well as the need to wear it at all times while in the welding shop
- identify proper hand and face protection as well as the need to wear it during any and all cutting, heating or welding operations
- identify proper footwear and clothing
- identify the dangers associated with contact lenses, butane lighters, exposed metal jewelry, long hair and beards
- identify the location of commonly used welding tools, face shields and leather jackets
- identify personal safety equipment that must be supplied by the student
- locate and identify shop lighting and ventilation controls
- locate and identify emergency shop exits
- understand emergency shop evacuation procedures
- locate and identify manifold shut-off valves for the shop gas system

**2. *Demonstrate and describe a sound working knowledge of the construction and safe operation acetylene and oxygen gas cylinders.*****Potential Elements of the Performance:**

- describe the physical construction of an oxygen cylinder and how it related to the construction of a typical compressed gas cylinder
- locate and identify the built-in safety devices for an oxygen cylinder
- identify oxygen cylinders, hoses, regulators and fittings by means of identification tag, name and color
- identify basic physical properties and dangers associated with the use of oxygen gas
- describe proper procedures for handling / transporting a compressed gas cylinder
- describe the physical construction of an acetylene cylinder
- locate and identify the built-in safety devices for an acetylene cylinder
- identify acetylene cylinders, hoses, regulators and fittings by means of identification tag, name and color
- identify basic physical properties and dangers associated with the use of acetylene gas
- describe proper procedures for handling / transporting an acetylene gas

cylinder

**3. Demonstrate and describe a sound working knowledge of how to set up and operate a typical oxyacetylene workstation.**

Potential Elements of the Performance:

- identify and select cutting, welding and heating tips based upon metal thickness and the manufacturer's recommendations
- select operating gas pressures based upon the torch manufacturer's recommendations
- perform a routine inspection of individual workstation to determine the condition of the torch body, hoses, regulators, threaded connections and tips
- ensure that all deficiencies are corrected prior to the commencement of shop activity
- pressurize and purge regulators, hoses, torch body and tips
- explain the dangers associated to the hazards of backfire and flashback
- explain the correct safe response to backfire and flashback
- perform specified procedures for flame ignition and adjustment
- identify and adjust gas flow in order to create
  - neutral flame
  - carburizing flame
  - oxidizing flame
- perform specified procedures for cleaning and shutting down their individual workstations

**4. Demonstrate a sound working knowledge of how to perform flame cutting and / or heating operations.**

Potential Elements of the Performance:

- describe potential fire, fume and associated with the flame cutting and or heating of metals
- identify proper flame cutting techniques including
  - flame type and height
  - tip angle and travel speed
  - correct appearance of drag lines
  - correct appearance of kerf shape and shoulder
  - flame cut materials to a specified length, size and shape
- flame cut shapes and brackets
- flame cut and remove fasteners
- heat, straighten and align simulated brackets and / or mounting hardware
- perform appropriate pressure settings and flame adjustments for specific flame cutting and / or heating operations

**5. Identify and Install Bolts and Bolts Assemblies to include...**

Potential Elements of the Performance:

- identify and select bolts, nuts and washers according to specified grade
- determine the correct thru hole diameter for a given bolt size
- locate and drill pilot and thru holes for a given bolts size
- correctly install and tighten a specified bolt assembly

- explain the negative effect of dirt and foreign material on threads while torque is applied to the bolt assembly
- explain the need to replace bolts whenever called for by the manufacturer's maintenance procedures
- explain the potential for failure of a bolted connection due to ...
  - oversized thru holes
  - combining the elements various bolt grades
  - using under strength bolts
  - repeated exposure to excessive heat

**6. Describe the functions, construction and principle(s) of operation of Shielded Metal Arc Welding equipment to include...**

Potential Elements of the Performance:

- identify, select and adjust welding helmets for comfort and use
- identify and select correct shade of filter lens based upon required welding current
- properly install filter lenses, gaskets, clear lens and retaining spring
- identify welding machine types
  - AC transformer
  - DC rectifier
  - DC inverters
- identify source(s) of high voltage electrical hazards
- identify arc welding cables, holders and ground clamps and inspect same for damage / unsafe condition(s)
- explain open circuit voltage, its amount and danger to the operator
- explain closed circuit voltage and its effect upon arc stability
- explain electron flow in welding and its use to determine weld polarity
- explain electrode deposition and penetration in relation to weld polarity
- identify electrodes according to type, size and AWS / CSA designation
- identify guidelines for electrode selection and application
- identify and describe weld characteristics of commonly used electrodes

**7. Demonstrate a sound working knowledge of how to perform arc welding operations in the flat and horizontal position**

Potential Elements of the Performance:

- perform a routine inspection of assigned workstation to determine the condition of welding machine, cables, electrode holders and related equipment
- correct deficiencies prior to the commencement of shop assignments
- describe techniques for arc ignition, electrode manipulation and travel speeds
- produce trial weld beads to identify possible defects and verify current settings
- make fillet welds in the flat and horizontal position using
  - 6011
  - 7018
  - 7024

- make groove welds in the flat and horizontal position using a combination of 6011 and 7018
- identify and troubleshoot the cause(s) of weld defects related to
  - arc blow
  - cracking
  - lack of fusion
  - lack of penetration
  - porosity
  - rough appearance
  - slag inclusion(s)
- perform destructive testing in order to determine weld soundness
- analyze failed welds for cause and explain cause(s)

### **III. TOPICS:**

1. Personal and Shop Safety
2. Construction and Safe Handling of Acetylene and Oxygen Gas Cylinders.
3. Setup and Operation of a Typical Oxyacetylene Workstation.
4. Bolts and Bolted Assemblies.
4. Flame Cutting and Heating Operations.
5. Functions, Construction and Principle(s) of Operation of Shielded Metal Arc Welding equipment
6. Arc Welding Operations in the Flat and Horizontal Position

### **IV. REQUIRED RESOURCES/TEXTS/MATERIALS:**

- CSA Approved (Impact Resistant) Safety Glasses
- CSA Approved (8 inch High Cut) Safety Work Boots
- CSA Approved (Gauntlet Type) Welding Gloves
- Appropriate Work Wear
- Pocket Note-pad for Shop Demonstration and Discussion Content
- Modules: Course Pack MET100

## V. EVALUATION PROCESS/GRADING SYSTEM:

### Part 1 – NOTES:

1. Re-writes are NOT allowed for any written assignment, quiz or test.
2. Repeats are NOT allowed for any shop test
3. Course attendance is mandatory. One percent (1 %) per hour will be deducted from the final course grade for apprentices with more than 4 hours of unexcused\* absence.

### **Any absence without a written, valid reason will be deemed unexcused.**

Valid reasons would include:

- Doctor's note
- Apprenticeship Ministry note
- Family Death or Serious Illness supported by a written note.

### Part 2 – FINAL COURSE GRADES:

The final course grade will be determined by means of the following list of weighted factors:

<b>Factor</b>	<b>Value</b>
Shop Assignments / Tests	65 %
Theory Quiz & Test	35 %
Attendance	-1% per Unexcused Hour
Shop Clean-up	-1% per Incident

The following semester grades will be assigned to students

<b>Grade</b>	<b>Definition</b>	<b>Grade Point Equivalent</b>
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	

X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

## VI. SPECIAL NOTES:

### **Attendance:**

Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session.

## VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.