



8414
METAL DESIGN/
FABRICATION & OXY-
ACETYLENE PROCEDURES
(11A)

30S/30E/30M

A Welding Technology Course

8414 METAL DESIGN/FABRICATION & OXY-ACETYLENE PROCEDURES (11A) 30S/30E/30M

Course Description

This course is intended for students who are considering a career in welding. The emphasis is on the design and fabrication of intermediate metal projects, as well as on oxy-acetylene procedures.

Goal 1: Describe and apply **health and safety** practices.

GLO 1.1: Demonstrate adherence to **safe practices** and **procedures**.

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| SLO 11A.1.1.1 | Demonstrate adherence to safe practices and procedures for facilities, processes, tools, and equipment. |
| SLO 11A.1.1.2 | Identify safety and health requirements. (A1.1) <ul style="list-style-type: none">■ overview of the <i>Workplace Safety and Health Act</i><ul style="list-style-type: none">– rights and responsibilities of employees under the <i>Act</i>– rights and responsibilities of employers under the <i>Act</i>– rights and responsibilities of supervisors under the <i>Act</i>■ fourteen (14) regulations■ codes of practice■ guidelines■ right to refuse<ul style="list-style-type: none">– explanation of right to refuse process– rights and responsibilities of employees– rights and responsibilities of employers– rights and responsibilities of supervisors under the <i>Act</i> |
| SLO 11A.1.1.3 | Identify personal protective equipment (PPE) and PPE procedures. (A1.2) <ul style="list-style-type: none">■ employer and employee responsibilities as related to PPE■ standards: CSA, ANSI, and guidelines■ work protective clothing and danger if it fits poorly |

- importance of selecting and using appropriate gloves to suit task (e.g., chemicals, cold/hot items, slivers, etc.)
- standards and requirements regarding selection/use of appropriate headwear
- eye protection—comparison/contrast eyeglasses, industrial safety glasses, and safety goggles
- foot protection—when required according to safety standards
- hearing protection
 - hazards of various noise levels (hearing protection must be worn)
 - laws
 - types of hearing protection
- respiratory protection—types; selection
- fall protection—Manitoba requirements Standards Guidelines
 - ANSI (U.S.A. standards), etc.
- ladders and scaffolding
- safety principles for working with or around industrial trucks site specific (forklifts, pallet trucks, etc.)

SLO 11A.1.1.4

Identify electrical safety. (A1.3)

- effects of electric current on the human body
- three factors that affect the severity of an electric shock
- the effects of electrical arcs/blasts on the human body and on equipment
- hazards/precautions regarding working with energized equipment

SLO 11A.1.1.5

Identify fire safety. (A1.4)

- types of fires
- types of firefighting equipment
- classifications of fire extinguishers (A, B, and C)
- location of fire extinguishers and fire exits
- fire alarms and drills

- SLO 11A.1.1.6 Identify ergonomics. (A1.5)
- definition of ergonomics and conditions that may affect the body
 - working postures
 - repetition
 - force
 - lifting
 - special hazards and precautions regarding materials handling
 - special hazards/precautions regarding lifting, carrying, and setting down a load
 - tools
 - identify tool and safety equipment
 - causes of hand tool accidents
 - equipment
- SLO 11A.1.1.7 Identify hazard recognition and control. (A1.6)
- safe-work practices
 - basic risk assessment
 - injury prevention and control measures
 - identification of hazards involved in pneumatic tool use and explanation of how to guard against them
- SLO 11A.1.1.8 Identify safety requirements as they apply to WHMIS. (A1.9)
- WHMIS as a system
 - provincial regulation under the *Safety and Health Act*
 - each province has a WHMIS regulation
 - *Federal Hazardous Products Act*
 - WHMIS generic training:
 - WHMIS defined and the format used to convey information about hazardous materials in the workplace
 - information found on supplier and workplace labeling using WHMIS
 - hazardous materials in accordance with WHMIS
 - compliance with government safety standards and regulations

- description of WHMIS (include varieties of WHMIS certification)
 - typology of WHMIS labels, symbols, and classifications
 - scope and use of Materials Safety Data Sheets (MSDS)

- SLO 11A.1.1.9 Describe the identification and control of specified hazards. (A1.10)
 - basic control measures (injury prevention)
 - safe work procedures
 - explanation on the importance of industrial housekeeping
 - employer responsibilities
 - how and where to store materials
 - safety measures related to walkways, stairs, and floor openings
 - traffic–pathway protection of workers and persons

- SLO 11A.1.1.10 Identify hazards and describe safe work practices pertaining to welding. (D1.3)
 - personal
 - shop/facility
 - fire and explosion
 - equipment
 - ventilation/fumes
 - storage, handling, and transportation

- SLO 11A.1.1.11 Read, interpret, and communicate safety information (e.g., MSDS sheets, etc.).
- SLO 11A.1.1.12 Safely store and handle compressed gas tanks.
- SLO 11A.1.1.13 Demonstrate an awareness of hazards related to compressed gas.
- SLO 11A.1.1.14 Demonstrate the safe use of compressed air.
- SLO 11A.1.1.15 Demonstrate an understanding of and adherence to *Safe Work Procedures/Job Hazards Analysis* documents for each piece of equipment used.
- SLO 11A.1.1.16 Demonstrate the safe use of a plasma arc cutter.

- SLO 11A.1.1.17 Identify first aid/cardiopulmonary resuscitation (CPR). (A1.8)
- overview of first-aid regulation
 - obligations of employers regarding first aid
 - Who is certified to provide first aid?
 - What to do while waiting for help?
 - location of, and access to, first-aid kit
 - define first aid, and explain first-aid requirements and techniques
 - scope and limits of first-aid intervention
 - specific interventions (cuts, burns, abrasions, fractures, suffocation, shock, electrical shock, etc.)
 - interface with other services and agencies (e.g., Workers Compensation claims)
 - describe basic CPR requirements and techniques
 - obtaining certification
 - scope and limits of CPR intervention (include varieties of CPR certification)
- SLO 11A.1.1.18 Describe the hazards of confined space entry. (A1.7)
- identification of a confined space
 - hazards of a confined space
 - physical
 - biological
 - working in a confined space
 - emergency response plan
 - self-contained breathing apparatus (SCBA)
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GLO 1.2: Demonstrate knowledge of the ***Trade Safety Awareness Curriculum for Level 1 Apprentices.***

No applicable SLOs.

Goal 2: Demonstrate an understanding of **metallurgy**.

GLO 2.1: Demonstrate an understanding of **metallurgy** as it applies to welding.

- SLO 11A.2.1.1 Demonstrate an understanding of metallurgy as it applies to metal design/fabrication and oxy-acetylene welding.
- SLO 11A.2.1.2 Select appropriate filler materials to suit base metal.
- SLO 11A.2.1.3 Utilize distortion-prevention strategies while welding.

Goal 3: Demonstrate the **identification, operation, maintenance, and storage** of **equipment, materials, and consumable items**.

GLO 3.1: Demonstrate the **identification** and **operation** of equipment, materials, and consumable items.

- SLO 11A.3.1.1 Demonstrate the operation and handling of equipment, tools, materials, products, and consumable items.
- SLO 11A.3.1.2 Adjust oxy-acetylene equipment for different processes, materials, and thicknesses.
- SLO 11A.3.1.3 Troubleshoot equipment settings after welding.

GLO 3.2: Demonstrate the safe and appropriate **maintenance** and **storage** of equipment, materials, and consumable items.

- SLO 11A.3.2.1 Follow safe procedures for cleaning and storing oxy-acetylene equipment.
- SLO 11A.3.2.2 Define terminology associated with stationary machinery. (A3.a.1)
- SLO 11A.3.2.3 Identify hazards and describe safe work practices pertaining to stationary machinery. (A3.a.2)
- SLO 11A.3.2.4 Identify types of stationary machinery, and describe their characteristics and applications. (A3.a.3)
 - presses
 - drill presses
 - stationary grinders
 - shears
 - saws
 - press brakes
 - ironworkers

- SLO 11A.3.2.5 Perform the procedures used to set up and operate stationary machinery. (A3.a.5)
- SLO 11A.3.2.6 Perform the procedures used to inspect and maintain stationary machinery. (A3.a.6)
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GLO 3.3: Demonstrate an awareness of **hoisting, lifting, and rigging** procedures.

No applicable SLOs.

GLO 3.4: Demonstrate an awareness of **access equipment**.

No applicable SLOs.

Goal 4: Demonstrate an understanding of **welding processes** and exhibit competence in those processes.

GLO 4.1: Demonstrate **pre-welding** procedures.

- SLO 11A.4.1.1 Prepare material for metal fabrication and oxy-acetylene procedures.
- SLO 11A.4.1.2 Identify types of power sources for welding equipment, and describe their applications and limitations. (D1.6)
- C transformer
 - AC/DC rectifier
 - DC generator
 - engine driven
 - alternators
 - generators
 - inverters

GLO 4.2: Demonstrate **ability to weld**.

- SLO 11A.4.2.1 Perform the procedures used to braze/weld using oxy-fuel equipment. (C3.12)
- SLO 11A.4.2.2 Sequence welds to minimize distortion, etc.
- SLO 11A.4.2.3 Perform 90° cuts using oxy-acetylene.
- SLO 11A.4.2.4 Perform circular cuts using oxy-acetylene.
- SLO 11A.4.2.5 Perform bevelled cuts using oxy-acetylene.

- SLO 11A.4.2.6 Identify welding positions and describe their applications. (D1.9)
- flat (1F or 1G)
 - horizontal (2F or 2G)
 - vertical (3F or 3G)
 - overhead (4F or 4G)
 - pipe fixed—horizontal (5F or 5G)
 - pipe fixed—45 degree plane (6F or 6G)
- SLO 11A.4.2.7 Perform cuts using a plasma arc cutter.
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GLO 4.3: Perform **post-welding** procedures.

- SLO 11A.4.3.1 Perform cleaning procedures (i.e., chipping, grinding) on a project.
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GLO 4.4: Inspect and troubleshoot welding projects.

- SLO 11A.4.4.1 Inspect and troubleshoot welding projects.
- SLO 11A.4.4.2 Describe the causes of weld defects found in intermediate projects and the methods for their prevention.
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GLO 4.5: Perform the **Manitoba Welder Practical Examinations**.

No applicable SLOs.

Goal 5: Demonstrate an understanding of **metal design and fabrication**.

GLO 5.1: Design metal projects.

- SLO 11A.5.1.1 Interpret information pertaining to welding on drawings. (D1.2)
- symbols
 - abbreviations
- SLO 11A.5.1.2 Perform a basic sketch of a proposed project.
- SLO 11A.5.1.3 Select appropriate material for project requirements.
- SLO 11A.5.1.4 Measure and lay out material.
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GLO 5.2: Fabricate metal projects.

- SLO 11A.5.2.1 Cut material for intermediate project, following specific measurements, angles, etc.
- SLO 11A.5.2.2 Perform accurate material preparation and fit-up for intermediate project.
- SLO 11A.5.2.3 Tack material for project.

Goal 6: Describe and apply the transferable **cross-curricular** knowledge and skills.

GLO 6.1: Apply knowledge and skills from the **language arts**.

- SLO 11A.6.1.1 Define terminology associated with GMAW welding. (D6.1)

GLO 6.2: Demonstrate the **mathematics** skills related to welding.

- SLO 11A.6.2.1 Accurately calculate and measure parts and angles for welding projects.
- SLO 11A.6.2.2 Read, interpret, and communicate welding terminology.
- SLO 11A.6.2.3 Read, interpret, and communicate information found on welding materials (e.g., filler rods, electrodes, etc.).

GLO 6.3: Demonstrate knowledge of **other subject areas**.

- SLO 11A.6.3.1 Demonstrate an understanding of the uses of electricity in welding (i.e., conductivity, current, voltage, amperage, polarity, AC versus DC).
- SLO 11A.6.3.2 Demonstrate an understanding of the states of matter.
- SLO 11A.6.3.3 Demonstrate an awareness of welding symbols.
- SLO 11A.6.3.4 Demonstrate an awareness of CNC technology.
- SLO 11A.6.3.5 Identify types of communication devices and describe their applications. (A1.a.2)

Goal 7: Follow the **ethical** and **legal standards** that pertain to the welding industry.

GLO 7.1: Demonstrate an awareness of the **ethical** and **legal expectations** of welders.

- SLO 11A.7.1.1 Demonstrate an understanding of the ethical concerns in the welding industry as they relate to safety.

Goal 8: Demonstrate employability skills.**GLO 8.1: Demonstrate employability skills.**

- SLO 11A.8.1.1 Demonstrate problem-solving skills.
- SLO 11A.8.1.2 Demonstrate regular attendance and punctuality.
- SLO 11A.8.1.3 Demonstrate accountability for their actions.
- SLO 11A.8.1.4 Demonstrate adaptability and effort.
- SLO 11A.8.1.5 Demonstrate the ability to accept and follow direction and feedback.
- SLO 11A.8.1.6 Demonstrate teamwork skills.
- SLO 11A.8.1.7 Demonstrate the ability to stay on task and effectively use time.
- SLO 11A.8.1.8 Describe effective verbal and non-verbal communication. (A1.a.1)
- SLO 11A.8.1.9 Demonstrate critical thinking skills.

Goal 9: Demonstrate an awareness of sustainability as it pertains to the welding industry.**GLO 9.1: Describe the impact of human sustainability on the health and well-being of welders.**

- SLO 11A.9.1.1 Appreciate the impact of sustainable practices on human health and well-being.
- SLO 11A.9.1.2 Demonstrate an understanding of the importance of working conditions on human sustainability.

GLO 9.2: Describe the welding industry's sustainability practices and impact on the environment.

- SLO 11A.9.2.1 Demonstrate an understanding of the importance of reducing waste in the welding industry.

GLO 9.3: Describe the sustainable business practices within the welding industry.

- SLO 11A.9.3.1 Demonstrate an awareness of the influence of welding on the local economy.
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Goal 10: Demonstrate an understanding of the **structure** and **scope** of welding.

GLO 10.1: Describe the **scope** of welding.

No applicable SLOs.

GLO 10.2: Describe **apprenticeship, post-secondary,** and **employment opportunities.**

SLO 11A.10.2.1 Demonstrate an awareness of training and career opportunities in metal design and fabrication.

Goal 11: Demonstrate an understanding of the **evolution, technological progression,** and **emerging trends** in welding.

GLO 11.1: Demonstrate an understanding of the **evolution, technological progression,** and **emerging trends** in welding.

SLO 11A.11.1.1 Demonstrate an awareness of the evolution of oxy-acetylene welding.
