



8489

ADVANCED METAL DESIGN/
FABRICATION (12C)

40S/40E/40M

A Welding Technology Course

8489 ADVANCED METAL DESIGN/FABRICATION (12C) 40S/40E/40M

Course Description

This course is intended for students who are intending to pursue a career in welding. The emphasis is on the design and fabrication of advanced metal projects.

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

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

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| SLO 12C.1.1.1 | Demonstrate adherence to safe practices and procedures for facilities, processes, tools, and equipment. |
| SLO 12C.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 12C.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 12C.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 12C.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 12C.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 12C.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 12C.1.1.8 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)
- SLO 12C.1.1.9 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 12C.1.1.10 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 12C.1.1.11 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 12C.1.1.12 Read, interpret, and communicate safety information (e.g., MSDS, etc.).
- SLO 12C.1.1.13 Safely store and handle compressed gas tanks.
- SLO 12C.1.1.14 Discuss hazards related to compressed gas.
- SLO 12C.1.1.15 Demonstrate the safe use of compressed air.
- SLO 12C.1.1.16 Demonstrate an understanding of and adherence to *Safe Work Procedures Job Hazards Analysis* documents for each piece of equipment that is used.
- SLO 12C.1.1.17 Identify hazards and describe safe work practices pertaining to GMAW welding. (D6.2)
- personal
 - shop/facility
 - fire and explosion
 - equipment
 - ventilation/fumes
 - storage, handling, and transportation
- SLO 12C.1.1.18 Demonstrate an understanding of the worker's responsibility to refuse unsafe work.
- SLO 12C.1.1.19 Identify hazards and describe safe work practices pertaining to SMAW welding. (D3.2)
- personal
 - shop/facility
 - fire and explosion
 - equipment
 - ventilation/fumes
 - storage/handling
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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 12C.2.1.1 Select appropriate filler materials to suit base metal.

SLO 12C.2.1.2 Demonstrate an awareness of physical and mechanical properties of different types of steel.

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 12C.3.1.1 Demonstrate the safe and appropriate operation and handling of equipment, tools, materials, products, and consumable items used in advanced metal design/fabrication.

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

SLO 12C.3.2.1 Practise the cleaning, maintenance, and storage of equipment, tools, materials, products, and consumable items used in advanced metal design/fabrication.

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 12C.4.1.1 Prepare material and equipment for advanced project.
- SLO 12C.4.1.2 Identify MCAW and FCAW welding processes, and describe their characteristics and applications. (D1.5.c & d)
- metal core arc welding (MCAW)
 - flux core arc welding (FCAW)
- SLO 12C.4.1.3 Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW fillet welds on low carbon steel in all positions. (D6.a.3)
- specification requirements
 - base metal
 - composition
 - thickness
 - shielding gas selection
 - welding position
 - joint type and design
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GLO 4.2: Demonstrate **ability to weld**.

- SLO 12C.4.2.1 Perform welds in an advanced welding project.
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GLO 4.3: Perform **post-welding** procedures.

- SLO 12C.4.3.1 Perform post-welding procedures for advanced projects.
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GLO 4.4: Inspect and **troubleshoot** welding projects.

- SLO 12C.4.4.1 Inspect and troubleshoot advanced project welds.
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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.

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| SLO 12C.5.1.1 | Demonstrate awareness of pattern development. |
| SLO 12C.5.1.2 | Demonstrate an awareness of geometric construction. |
| SLO 12C.5.1.3 | Identify basic isometric and oblique drawings. |
| SLO 12C.5.1.4 | Develop a shop drawing of a metals project. |
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GLO 5.2: Fabricate metal projects.

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| SLO 12C.5.2.1 | Cut, prep, and tack the five basic weld joints. |
| SLO 12C.5.2.2 | Fabricate advanced metal projects. |
| SLO 12C.5.2.3 | Cut material for an advanced project, following specific measurements, angles, etc. |
| SLO 12C.5.2.4 | Perform material preparation and fit-up for an advanced project. |
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Goal 6: Describe and apply the transferable **cross-curricular** knowledge and skills.

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

No applicable SLOs.

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

No applicable SLOs.

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

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| SLO 12C.6.3.1 | Demonstrate an awareness of the use of information and communication technology in creating electronic portfolios and searching for employment. |
| SLO 12C.6.3.2 | Read, interpret, and communicate welding symbols. |
| SLO 12C.6.3.3 | Read and interpret blueprints and welding symbols. |
| SLO 12C.6.3.4 | Identify types of trades related to documentation, and describe their applications and procedures for use.
(A1.a.3) <ul style="list-style-type: none">■ manufacturers' specifications■ safety/hazard assessment forms■ mill certificates■ heat numbers |

- customer specifications
- codes and standards
- manuals/catalogues
- work orders
- requisitions/purchase orders, permits, procedure sheets
- welding symbols

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 12C.7.1.1 Demonstrate ethics by practising quality workmanship.
- SLO 12C.7.1.2 Identify codes and standards pertaining to welding. (D1.4)
 - Canadian Standards Association (CSA)
 - American Society of Mechanical Engineers (ASME)
 - American Welding Society (AWS)

Goal 8: Demonstrate **employability skills**.

GLO 8.1: Demonstrate **employability skills**.

- SLO 12C.8.1.1 Demonstrate problem-solving skills.
 - SLO 12C.8.1.2 Demonstrate critical thinking skills.
 - SLO 12C.8.1.3 Demonstrate regular attendance and punctuality.
 - SLO 12C.8.1.4 Demonstrate accountability for their actions.
 - SLO 12C.8.1.5 Demonstrate adaptability, initiative, and effort.
 - SLO 12C.8.1.6 Demonstrate the ability to accept and follow direction and feedback.
 - SLO 12C.8.1.7 Demonstrate teamwork skills.
 - SLO 12C.8.1.8 Demonstrate the ability to stay on task and effectively use time in class and shop environments.
 - SLO 12C.8.1.9 Demonstrate the ability to communicate respectfully and effectively with teachers and students.
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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.

No applicable SLOs.

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

SLO 12C.9.2.1 Demonstrate an awareness of the impact of welding work sites on the environment.

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

No applicable SLOs.

Goal 10: Demonstrate an understanding of the **structure** and **scope** of welding.

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

SLO 12C.10.1.1 Demonstrate an awareness of the scope of metal design and fabrication.

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

SLO 12C.10.2.1 Demonstrate an awareness of employment opportunities in metal design/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 12C.11.1.1 Demonstrate an awareness of technological progression and emerging trends in metal design and fabrication.
