



8378

INTRODUCTION TO WELDING
TECHNOLOGY (10)

20S/20E/20M

A Welding Technology Course

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Course Description

This course is intended to introduce students to a potential career in welding. The emphasis is on hands-on basic welding activities using GMAW (MIG), SMAW (ARC), and oxy-acetylene equipment.

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

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

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| SLO 10.1.1.1 | Demonstrate adherence to safe practices and procedures for facilities, processes, tools, and equipment. |
| SLO 10.1.1.2 | 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 10.1.1.3 | 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 10.1.1.4

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 10.1.1.5

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 10.1.1.6 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 10.1.1.7 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 10.1.1.8 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 10.1.1.9 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 10.1.1.10 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 10.1.1.11 Read, interpret, and communicate safety information (e.g., MSDS sheets, etc.).
- SLO 10.1.1.12 Safely store and handle compressed gas tanks.
- SLO 10.1.1.13 Demonstrate an awareness of hazards related to compressed gas.
- SLO 10.1.1.14 Demonstrate the safe use of compressed air.
- SLO 10.1.1.15 Demonstrate an understanding of and adherence to *Safe Work Procedures/Job Hazards Analysis* documents for each piece of equipment used.
- SLO 10.1.1.16 Demonstrate the safe use of a plasma arc cutter.

- SLO 10.1.1.17 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)
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GLO 1.2: Demonstrate knowledge of the *Trade Safety Awareness Curriculum for Level 1 Apprentices*.

- SLO 10.1.2.1 Explain the importance of trade safety and health in reducing injuries and fatalities to young employees in Manitoba. (TSA 1)
- SLO 10.1.2.2 Describe the rights and responsibilities of employees, employers, and supervisors under the *Workplace Safety and Health Act*. (TSA 2)
- SLO 10.1.2.3 Describe the steps to use in the Right to Refuse process. (TSA 3)
- SLO 10.1.2.4 Explain how and where to find information on workplace safety and health. (TSA 4)
- SLO 10.1.2.5 Demonstrate how to handle a potentially dangerous work situation. (TSA 5)
- SLO 10.1.2.6 Explain the S.A.F.E. acronym. (TSA 6)
- SLO 10.1.2.7 Define workplace safety and health hazards. (TSA 7)
- SLO 10.1.2.8 Give examples of trade-specific workplace safety and health hazards. (TSA 8)
- SLO 10.1.2.9 Give examples of five types of safety and health hazards. (TSA 9)

SLO 10.1.2.10	Define workplace safety and health risks. (TSA 10)
SLO 10.1.2.11	Give examples of trade-specific workplace safety and health risks. (TSA 11)
SLO 10.1.2.12	Explain the principles of hazard recognition and control as they apply to welding. (TSA 12)
SLO 10.1.2.13	Explain the Workplace Hazardous Material Information System (WHMIS). (TSA 13)
SLO 10.1.2.14	Match the WHMIS hazardous materials symbols and their meanings. (TSA 14)
SLO 10.1.2.15	Describe the importance of the Material Safety Data Sheets (MSDS). (TSA 15)
SLO 10.1.2.16	Describe the importance of using personal protective equipment (PPE). (TSA 16)
SLO 10.1.2.17	Demonstrate proper selection and use of a variety of personal protective equipment and fall protection systems. (TSA 17)
SLO 10.1.2.18	Outline the safety principles for working on and around electrical equipment. (TSA 18)
SLO 10.1.2.19	Outline workplace fire safety principles. (TSA 19)
SLO 10.1.2.20	Identify the hazards in confined spaces and the preparation needed to work in a confined space. (TSA 20)

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

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

SLO 10.2.1.1	Demonstrate an understanding of metallurgy as it applies to welding.
SLO 10.2.1.2	Select appropriate filler materials to suit base metal.
SLO 10.2.1.3	Demonstrate an awareness of the tendency for metals to distort.
SLO 10.2.1.4	Distinguish between ferrous and non-ferrous metals.
SLO 10.2.1.5	Demonstrate an awareness of different rates of thermal conductivity found in various metals.
SLO 10.2.1.6	Distinguish between stainless steel, mild steel, and aluminum.

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 10.3.1.1 Demonstrate the operation and handling of equipment, tools, materials, products, and consumable items.
- SLO 10.3.1.2 Identify types of hand tools, and describe their applications and procedures for use. (A3.2)
- SLO 10.3.1.3 Identify types of power tools, and describe their applications and procedures for use. (A3.4)
 - electric
 - hydraulic
 - pneumatic

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

- SLO 10.3.2.1 Practise the appropriate cleaning maintenance, and storage of welding equipment, tools, materials, products, and consumable items.
- SLO 10.3.2.2 Clean, maintain, and store plasma cutters and consumables.
- SLO 10.3.2.3 Describe the procedures used to inspect, maintain, and store hand tools. (A3.3)
- SLO 10.3.2.4 Identify power tool attachments and consumables, and describe their applications and procedures for use. (A3.5)
- SLO 10.3.2.5 Describe the procedures used to inspect, maintain, and store power tools. (A3.6)
- SLO 10.3.2.6 Identify types of layout and measuring tools and equipment, and describe their applications and procedures for use. (A3.7)
- SLO 10.3.2.7 Describe the procedures used to inspect, maintain, and store layout and measuring tools and equipment. (A3.8)
- SLO 10.3.2.8 Describe the procedures used to inspect and maintain oxy-fuel equipment. (C3.7)

- SLO 10.3.2.9 Perform the procedures used to inspect, maintain, and troubleshoot OFW welding equipment. (C3.8, C3.9)
- free hand
 - guided
 - straight edge
 - pattern
 - automatic/semi-automated
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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 10.4.1.1 Identify SMAW and GMAW welding processes, and describe their characteristics and applications. (D1.5.a & b)
- shielded metal arc welding (SMAW)
 - gas metal arc welding (GMAW)
- SLO 10.4.1.2 Prepare material and equipment for welding.
- SLO 10.4.1.3 Identify types of flames, and describe their application and the procedures for flame adjustment. (C3.5)
- oxidizing
 - carburizing
 - neutral
- SLO 10.4.1.4 Perform the procedures used to set up, adjust, and shut down oxy-fuel equipment. (C3.6)
- manufacturers' recommendations
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GLO 4.2: Demonstrate ability to weld.

- SLO 10.4.2.1 Identify GMAW welding.
- SLO 10.4.2.2 Perform the procedures and techniques used to deposit a weld bead using GMAW welding equipment. (D6.9)
- SLO 10.4.2.3 Identify hazards and describe safe work practices pertaining to oxy-fuel cutting, gouging, and welding. (C3.2)
- personal
 - shop/facility
 - fire and explosion
 - equipment
 - ventilation/fumes
 - storage, handling, and transportation
- SLO 10.4.2.4 Identify oxy-fuel equipment and accessories, and describe their applications and limitations. (C3.4)
- cutting
 - gouging
 - welding
 - brazing/braze-welding
 - heating
- SLO 10.4.2.5 Set up, operate, and shut down oxy-fuel equipment. (C3.13)
- SLO 10.4.2.6 Perform SMAW welds.
- SLO 10.4.2.7 Identify the types of beads, and describe their characteristics and applications. (D1.7)
- stringer
 - weave
- SLO 10.4.2.8 Identify types of welds, and describe their characteristics and applications. (D1.8)
- fillet
 - groove
 - surfacing
 - plug or slot
- SLO 10.4.2.9 Describe the procedures used to strike and maintain an arc using SMAW welding equipment. (D3.6, D3.9)
- SLO 10.4.2.10 Perform the procedures used to weld using oxy-fuel equipment. (C3.11)
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GLO 4.3: Perform **post-welding** procedures.

SLO 10.4.3.1 Perform cleaning procedures (i.e., chipping, grinding).

GLO 4.4: Inspect and troubleshoot welding projects.

SLO 10.4.4.1 Inspect and troubleshoot welding projects.

SLO 10.4.4.2 Perform the procedures used to prevent and correct weld faults. (D3.a.7)

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 10.5.1.1 Read, interpret, and communicate shop sketches.

SLO 10.5.1.2 Select appropriate materials.

SLO 10.5.1.3 Measure and lay out material.

GLO 5.2: Fabricate metal projects.

SLO 10.5.2.1 Cut material for an introductory project following broad measurements, angles, etc.

SLO 10.5.2.2 Perform basic material preparation and fit-up.

SLO 10.5.2.3 Tack material using GMAW and SMAW procedures.

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

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

SLO 10.6.1.1 Define terminology associated with GMAW welding. (D6.1)

SLO 10.6.1.2 Define terminology associated with oxy-fuel cutting, gouging, and welding. (C3.1)

SLO 10.6.1.3 Define terminology associated with welding. (D1.1)

SLO 10.6.1.4 Define terminology associated with SMAW welding. (D3.1)

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

- SLO 10.6.2.1 Demonstrate basic measurement skills.
 - SLO 10.6.2.2 Calculate perimeter and area.
 - SLO 10.6.2.3 Calculate volume of cylinders.
 - SLO 10.6.2.4 Read, interpret, and communicate welding terminology.
 - SLO 10.6.2.5 Read, interpret, and communicate information found on welding materials (e.g., filler rods, electrodes, etc.).
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GLO 6.3: Demonstrate knowledge of **other subject areas**.

- SLO 10.6.3.1 Demonstrate an understanding of the uses of electricity in welding (i.e., conductivity, current, voltage, amperage, polarity, AC versus DC).
 - SLO 10.6.3.2 Demonstrate an understanding of the states of matter.
 - SLO 10.6.3.3 Demonstrate an awareness of welding symbols.
 - SLO 10.6.3.4 Demonstrate the use of information and communication technology in order to research topics in welding.
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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 10.7.1.1 Demonstrate an awareness of the ethical and legal standards.
 - SLO 10.7.1.2 Demonstrate an understanding of the ethical and legal expectations of welders.
 - SLO 10.3.1.3 Interpret regulations pertaining to tools and equipment. (A3.1)
 - SLO 10.7.1.4 Identify and interpret codes and regulations pertaining to oxy-fuel cutting, gouging, and welding equipment and operations. (C3.3)
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Goal 8: Demonstrate **employability skills**.

GLO 8.1: Demonstrate **employability skills**.

- SLO 10.8.1.1 Demonstrate problem-solving skills.
- SLO 10.8.1.2 Demonstrate regular attendance and punctuality.
- SLO 10.8.1.3 Demonstrate accountability for their actions.
- SLO 10.8.1.4 Demonstrate adaptability and effort.
- SLO 10.8.1.5 Demonstrate the ability to accept and follow direction and feedback.

SLO 10.8.1.6	Demonstrate teamwork skills.
SLO 10.8.1.7	Demonstrate the ability to stay on task and effectively use time.
SLO 10.8.1.8	Describe effective verbal and non-verbal communication. (A1.a.1)

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 10.9.1.1	Demonstrate an understanding of sustainability as it relates to human health and well-being.
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GLO 9.2: Describe the welding industry's **sustainability practices** and impact on the environment.

SLO 10.9.2.1	Demonstrate an understanding of the importance of recycling metal used in the welding industry.
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GLO 9.3: Describe the **sustainable business practices** within the welding industry.

SLO 10.9.3.1	Identify which industries hire welders.
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Goal 10: Demonstrate an understanding of the **structure** and **scope** of welding.

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

SLO 10.10.1.1	Describe the structure and scope of the modern welding trade. (A2.1) <ul style="list-style-type: none"> ■ historical background, including apprentice experience ■ structure/scope of the trade <ul style="list-style-type: none"> – international and national characteristics – characteristics and practice of the trade in Manitoba – trade organizations ■ opportunities and career ladders <ul style="list-style-type: none"> – generalists and specialists – lead hands and other immediate supervisors – geographic mobility – job hierarchies and innovations
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GLO 10.2: Describe **apprenticeship, post-secondary,** and **employment opportunities.**

- SLO 10.10.2.1 Demonstrate an awareness of career opportunities in welding.
- SLO 10.10.2.2 Demonstrate an awareness of the benefits of certification in welding.
- SLO 10.10.2.3 Demonstrate an awareness of apprenticeship.

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 10.11.1.1 Research the evolution of welding, including its technological progression and emerging trends.
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