Grade 12A Advanced GMAW (MIG) Procedures

Course Code	8487
Course Credit	1.0

Senior Years Technology Education Program

Discipline Overview

An approved technical-vocational education (TVE) program cluster comprises departmentally developed and/or approved courses in one specific trade or trained occupation that facilitates the transition from school to either post-secondary training (such as the training provided through Apprenticeship Manitoba) or entry into the workforce (often at an entry-level position).

When learners pursue their studies in an environment modelled after the workplace, they will acquire not only trade-related skills, but will also develop

- employability skills required to make an effective transition from school to work
- an understanding of career development and planning
- an understanding of the importance of becoming an autonomous, lifelong learner in order to adapt to the skills and knowledge needed in the future
- an awareness of safety in school, in the workplace, and at home
- an awareness of sustainability as it relates to the specific skilled trade area and society

Course Overview

In this course, learners will deepen their understanding of semi-automatic wire feed welding and quality inspection, building on the knowledge gained in the fundamental course. Learners will continue to expand their expertise in the welding profession, including safety practices, tools and equipment, and the selection and use of materials and consumables. This advanced course emphasizes more complex procedures and advanced positional semi-automatic wire feed welding and quality inspection.

This course focuses on the following units in the Apprenticeship Manitoba Level 1 technical training:

- A8 Weld Process and Quality Inspection I
- A12 Semi-Automatic Wire Feed Welding I

The learning outcomes in this course may not follow a fixed sequence, as they are organized to align with Apprenticeship Manitoba standards. Only the outcomes relevant to this course are included. A complete list of learning outcomes can be found in the primary learning outcomes resource.

Manitoba

Global Competencies in Welding Technology

Critical Thinking

Critical thinking in welding technology involves the intentional process of synthesizing and analyzing ideas using criteria and evidence, making reasoned judgments, and reflecting on the outcomes and implications of those judgments.

When critical thinking as a competency is applied in welding technology, learners

- find and use sources strategically, efficiently, and effectively for the design and management of projects
- evaluate sources for bias, relevance, and reliability for use in training and occupations
- analyze and synthesize ideas using criteria and evidence that demonstrate awareness of emerging trends
- reflect on sources and experiences from multiple perspectives
- enhance comprehension, clarify meaning, make connections, and expand experiences through questioning
- make judgments based on observation, experience, and evidence
- weigh criteria to apply safe practices and make ethical decisions

Creativity

Creativity in welding technology involves exploring and playing with ideas and concepts in order to represent thinking, solve problems, explore opportunities, and innovate in unique ways. It is the interaction between intuition and thinking.

When creativity as a competency is applied in welding technology, learners

- demonstrate initiative, open-mindedness, inventiveness, flexibility, and a willingness to take prudent risks in thinking through projects/processes and recognizing safety protocols
- demonstrate curiosity by exploring new ideas, possibilities, and emerging trends, as well as by asking relevant questions
- use theoretical and applied strategies by making adaptations and adjustments to solve a problem and generate innovative ideas
- enhance innovative ideas by building on the ideas of others
- create a plan for a project and adjust it as needed to achieve the goal of successfully meeting a learning outcome
- research, develop, test, and adapt designs and ideas, as well as build on prior knowledge to persevere through obstacles
- reflect by welcoming feedback from others to enhance the process

Citizenship

Citizenship in welding technology involves engaging and working toward a more equitable, compassionate, and sustainable world by developing and valuing relationships to self, others, and the natural world.

When citizenship as a competency is applied in welding technology, learners

- understand their own perspective on issues related to economies on a global, regional, and local level
- recognize discrimination, principles of equity, and human rights in their world
- explore the interconnectedness of self, the workplace, and the natural world
- welcome diverse viewpoints, experiences, and world views and how they contribute to building relationships and practices
- empathize with multiple viewpoints to better understand consumers, markets, workplaces, teams, and co-workers
- connect with others in responsible, respectful, and inclusive ways, both in person and in digital contexts
- realize their potential in contributing to the betterment of community near and far
- evaluate factors such as the impact of diversity, equity, and inclusion in the workplace, and propose solutions to support well-being
- make ethical choices to promote healthy and sustainable outcomes

Connection to Self

Connection to self in welding technology involves awareness of the related nature of emotional, intellectual, physical, social, cultural, and spiritual aspects of living and learning, and the responsibility for personal growth, well-being, and well-becoming.

When connection to self as a competency is applied in welding technology, learners

- recognize personal strengths, gifts, and challenges to support their learning and well-being
- come to know the factors that shape their identity through exploration
- use workplace skills and practices to enhance self-regulation, personal comfort, sense of well-being, and efficiency
- reflect on own decisions, effort, and experiences, and others' feedback for improvement
- set goals to strengthen their career and personal aspirations
- create a personal plan that reflects their career goals, encompassing their strengths and interests
- value and practise resilience as they work through mistakes and overcome obstacles

- adapt and modify their planning when presented with obstacles or new information
- recognize and embrace their role in lifelong learning, well-being, and well-becoming

Collaboration

Collaboration in welding technology involves learning with and from others and working together with a shared commitment to a common goal.

When collaboration as a competency is applied in welding technology, learners

- welcome diverse viewpoints, experiences, and world views, and appreciate how they contribute to building relationships and practices
- build on each other's ideas through discussion, sharing stories, models, and simulations, and incorporate this learning into practical applications
- value and put trust in others' contributions when working together to ensure safe practices
- formulate questions of themselves and others to generate new ideas and deepen understanding
- work through differences and show a willingness to compromise or change perspective by demonstrating effective conflict resolution practices/strategies and appropriate workplace etiquette and protocols
- co-construct understanding of current practices and emerging technologies
- commit to their roles to co-construct, design, and manage projects

Communication

Communication in welding technology involves interacting with others and allowing for a message to be received, expressed, and understood in multiple ways and for a variety of purposes.

When communication as a competency is applied in welding technology, learners

- express ideas while using workplace conventions and professionalism
- understand context, adapting to different audiences, and conveying information clearly and concisely
- understand how their words and actions shape their identity or have an impact
- understand protocols and practices and use them to understand and interpret messages
- seek to understand others' ideas and instructions through active listening and questioning
- recognize that diverse perspectives (of language, culture, age, etc.) can influence understanding

- make meaning and deepen understanding through their language and the languages of clients and colleagues
- build relationships through meaningful interactions using inclusive and respectful language, and correct terminology, both in person and in digital contexts
- recognize the benefits of communication to build community

Enduring Understandings

Explore career opportunities.

Technical-vocational education supports learners to understand the unique characteristics, scope, working conditions, and career opportunities of various occupations to make informed choices.

Create safe, healthy, and effective workspaces.

Technical-vocational education provides learners with safe, healthy, and effective work practices and protocols that meet industry standards for technical competence and professionalism.

Navigate the world.

Technical-vocational education prepares learners with attitudes, skills, and knowledge to successfully navigate complex, competitive, and collaborative environments to develop an awareness of regulations, cultural competence, and ethical practices.

Experience connected and innovative learning.

Technical-vocational education readies learners to be entrepreneurial and innovative thinkers while making cross-curricular connections and transdisciplinary experiences (STEAM), utilizing industry standard digital tools and technologies, and fostering awareness of industry trends.

Promote inclusive and responsive systems.

Technical-vocational education promotes equity, diversity, and inclusion, is responsive to global challenges, and promotes environmental stewardship to prepare learners for an interconnected world.

Prepare for evolving economies.

Technical-vocational education equips learners with relevant and adaptable skills to become lifelong learners in an ever-changing world.

Learning Outcomes

With independence and an emerging ability to guide others, learners can achieve the following learning outcomes.

Strand A: Trade Safety (A2)

WEL-12A-A2 Recognize, explain, and demonstrate personal protective equipment (PPE) requirements and standards in the workplace.

WEL-12A-A2-1 **Recognize** various personal protective equipment (PPE), including

- eye protection
- face protection
- hearing protection
- foot protection
- head protection
- hand protection
- skin protection
- respiratory protection
- protective clothing
- fall protection (trade-specific)

WEL-12A-A2-2 **Explain** various personal protective equipment (PPE), including

- selection of the appropriate PPE
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-A2-3 **Demonstrate** how to use the required personal protective equipment (PPE), ensuring

- a proper fit
- a proper seal
- it is worn properly
- an understanding of the procedures for reporting any damage or malfunctions

WEL-12A-A5 Recognize and explain injury prevention.

WEL-12A-A5-1 Recognize, explain, and demonstrate the **SAFE acronym**.

- **S**pot the hazard
- **A**ssess the risk
- **F**ind a safer way
- **E**very day

WEL-12A-A5-12 Demonstrate knowledge of the **locations of various fire emergency safety equipment** and evacuation safety measures, including

- fire extinguisher
- alarm pull stations
- emergency exits
- muster points

WEL-12A-A6 Recognize and explain injury response.

WEL-12A-A6-2 Explain how to **report an injury**, including to

- a teacher or supervisor
- Workers Compensation Board of Manitoba (WCB)

WEL-12A-A6-3 Demonstrate knowledge of the **locations of various emergency safety equipment**, including

- first aid kit
- automated external defibrillator (AED)
- eyewash station

Strand B: Career Education (A1)

WEL-12A-B1 Explain the structure and scope of the welding trade.

WEL-12A-B1-1 Explain opportunities and future **career paths** in a trade, including

- becoming a specialist
- moving into leadership
- working in different locations
- growing with new technology

WEL-12A-B2 Explain the levels of workplace competency.

WEL-12A-B2-1 Explain **job competencies** workers and learners need to know related to **workplace culture**, including

- understanding tools and materials
- using the right skills to do the job well

WEL-12A-B2-2 Explain the **social competencies** workers and learners need to know related to **workplace culture**, including

- working well with others
- using appropriate language
- respecting different beliefs
- understanding workplace rules
- supporting fairness and inclusion.

Strand C: Trade-Related Communications (A4)

WEL-12A-C1 Explain and demonstrate techniques for effective verbal and non-verbal communication.

WEL-12A-C1-1 Explain how to communicate clearly and respectfully with different people at school and/or work, using both **words and body language**.

WEL-12A-C1-2 Demonstrate how to communicate clearly and respectfully with different people at school and/or work, using both **words and body language**.

WEL-12A-C2 Recognize workplace behaviours and communication that constitute bullying, as defined by the Canadian Human Rights Act and jurisdictional human rights laws.

WEL-12A-C2-1 Recognize what **respectful workplace** values look like and what kinds of behaviour are considered bullying, harassment, or discrimination under Canadian law.

WEL-12A-C3 Demonstrate effective communication skills, and practise active listening and response.

WEL-12A-C3-1 Demonstrate **effective communication and active listening,** including

- listening carefully
- responding clearly
- using appropriate body language

- asking questions
- being open to feedback

Strand D: Trade-Related Mathematics (A5)

WEL-12A-D1 Use mathematical properties to solve problems involving whole, fractional, decimal, and percentage numbers, with an emphasis on trade-related problems.

WEL-12A-D1-1 Demonstrate how to solve math problems with both **positive and negative numbers**, indicating how the signs (+ or –) affect the answer, when

- adding
- subtracting
- multiplying
- dividing

WEL-12A-D1-2 Recognize various **types of fractions**, including

- proper fractions
- improper fractions
- mixed fractions

WEL-12A-D1-3 Explain various **types of fractions**, including

- a proper fraction has a smaller number on top (like $\frac{3}{4}$)
- an improper fraction has a bigger number on top (like $\frac{5}{3}$)
- a mixed fraction combines a whole number and a fraction (like $1\frac{2}{3}$)

WEL-12A-D1-4 Demonstrate how to add and subtract **fractions**.

WEL-12A-D1-5 Demonstrate how to multiply, divide, simplify (reduce), and expand **fractions.**

WEL-12A-D1-6 Demonstrate how to change a fraction into a **decimal** and a decimal into a fraction.

WEL-12A-D2 Demonstrate how to communicate measurements.

WEL-12A-D2-1 Demonstrate how to **measure.**

WEL-12A-D2-2 Demonstrate how to **measure** using both **metric and customary** (imperial) measurement systems, such as when

- measuring length
- measuring materials

WEL-12A-D2-3 Demonstrate how to provide **measurements,** including how much the measurements can vary (e.g., bead width).

Strand E: Tools and Equipment (A3)

WEL-12A-E1 Recognize, explain, and demonstrate an understanding of terminology associated with tools and equipment.

WEL-12A-E1-1 Recognize **key terms** and names of various tools and equipment.

WEL-12A-E1-2 Explain the **names** and **purposes** of various tools and equipment.

WEL-12A-E1-3 Demonstrate an understanding of the **names** and **purposes** of various tools and equipment.

WEL-12A-E2 Recognize the various hazards associated with tools and equipment, and explain and demonstrate the related safe work practices.

WEL-12A-E2-1 Recognize various **hazards of tools** and equipment, including

- harmful noise levels
- lacerations caused by sharp tools or materials
- crush injury hazards
- moving parts on machines that can catch and trap hands or garments
- flying debris hazards

WEL-12A-E2-2 Explain **safe work practices** for various tools and equipment, including

- wearing appropriate personal protective equipment (PPE)
- inspecting tools and equipment before use
- using the correct tool for the job
- keeping the work area clean and organized
- following manufacturer instructions and safety guidelines
- disconnecting power tools when not in use or during maintenance
- reporting and removing damaged tools from service
- staying alert and avoiding distractions while working
- using guards and safety devices as intended
- storing tools properly after use

WEL-12A-E2-3 Demonstrate safe work practices related to tools and equipment.

WEL-12A-E3 Demonstrate how to safely and properly use various tools and equipment.

WEL-12A-E3-1 Demonstrate how to safely and properly use various **tools and equipment.**

Strand F: Materials and Consumables

WEL-12A-F1 Share and discuss Indigenous perspectives and environmental impacts.

WEL-12A-F1-1 Share and discuss an **Indigenous perspective** on material selection, emphasizing sustainability, respect for natural resources, and cultural significance, such as

- principles of the honourable harvest
- four sacred elements (earth, wind, water, fire)
- inviting an Elder to teach sustainability

WEL-12A-F1-2 Share and discuss the **environmental impact** of selecting and disposing of various materials.

WEL-12A-F2 Recognize the various hazards associated with consumables and materials, and explain and demonstrate the related safe work practices.

WEL-12A-F2-1 Identify various **hazards** for welding consumables and materials, including

- burns
- lifting
- flux dust

WEL-12A-F2-2 Explain various **safe work practices** for consumables and materials, including

- wearing appropriate personal protective equipment (PPE)
- inspecting consumables and materials before use
- using the correct consumables and materials for the job
- keeping the work area clean and organized
- following manufacturer instructions and safety guidelines
- reporting and removing damaged consumables and materials from service
- staying alert and avoiding distractions while working
- storing consumables and materials properly after use

WEL-12A-F2-3 Demonstrate safe work practices related to **consumables and materials**.

Strand G: Material Handling and Access Equipment

WEL-12A-G1 Recognize, define, and demonstrate terminology associated with material handling.

WEL-12A-G1-1 Recognize an understanding of the **key terms and names** of different types of material handling.

WEL-12A-G1-2 Explain an understanding of the **names and purposes** of different types of material handling.

WEL-12A-G1-3 Demonstrate an understanding of the **names and purposes** of different types of material handling.

Strand I: Weld Process and Quality Inspection (A8)

WEL-12A-I1 Recognize, explain, and demonstrate an understanding of terminology associated with weld processes and quality inspection.

WEL-12A-I1-1 Recognize an understanding of the **key terms** and **names** of different weld processes, and of quality inspection.

WEL-12A-I1-2 Explain an understanding of the **names and purposes** of different weld processes, and of quality inspection.

WEL-12A-I1-3 Demonstrate an understanding of the **names and purposes** of different weld processes, and of quality inspection.

WEL-12A-I2 Recognize the various hazards associated with weld processes and quality inspection, and explain and demonstrate the related safe work practices.

WEL-12A-I2-1 Recognize various **gas cylinder hazards**, including

- explosions
- displacement of oxygen (asphyxiation)

WEL-12A-I2-2 Explain the safe work practices for **gas cylinder hazards**, including safety data sheets (SDS).

WEL-12A-I2-3 Recognize various **final product hazards**, including

- cuts
- particulate projection/sparks
- dust particulate inhalation
- toxic chemicals

WEL-12A-I2-4 Explain various safe work practices for **final product hazards**.

WEL-12A-I2-5 Recognize various hazards related to **controlling temperature of weldments**, including

- electrical shock
- burns

WEL-12A-I2-6 Explain various safe work practices related to **controlling temperature of weldments**.

WEL-12A-I2-7 Demonstrate safe work practices related to **weld processes and quality inspection.**

WEL-12A-I3 Interpret jurisdictional codes, regulations, and job specifications pertaining to weld processes and quality inspection.

WEL-12A-I3-1 Understand and apply the rules and job requirements that relate to how welding is done and how its quality is checked, based on the laws and standards in a specific area.

WEL-12A-I4 Recognize and explain welding consumables and gas cylinders, including their characteristics, applications, and storage.

WEL-12A-I4-1 Recognize various **welding consumables**, including

- electrodes
- welding wires
- welding fluxes

WEL-12A-I4-2 Explain various **welding consumables**, including

- selection of the appropriate welding consumable
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-I4-3 Recognize various **gas cylinder** product types and identification, including

- fuel gas
- oxygen gas
- inert gas
- active gas

WEL-12A-I4-4 Explain various **gas cylinder** product types and identification, including

- selection of the appropriate gas cylinder product type

- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12-I5 Demonstrate how to safely and properly use welding consumables and gas cylinders.

WEL-12-I5-1 Demonstrate how to safely and properly use welding consumables and gas cylinders.

WEL-12A-I6 Recognize and explain welding processes, including their selection, characteristics, and applications.

WEL-12A-I6-1 Recognize various **welding processes**, including
- flux-cored arc welding (FCAW)
- metal-cored arc welding (MCAW)
- gas metal arc welding (GMAW)

WEL-12A-I6-2 Explain various **welding processes**, including
- selection of the appropriate welding process
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-I6-3 Recognize various welding **power sources**, such as
- transformer
- transformer-rectifier
- inverter
- engine-driven

WEL-12A-I6-4 Explain various welding **power sources**, such as
- selection of the appropriate welding power source
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-I6-5 Recognize various **welding polarities**, such as
- direct current electrode negative (DCEN)

- direct current electrode positive (DCEP)
- alternating current (AC)

WEL-12A-I6-6 Explain various **welding polarities**, such as
- selection of the appropriate welding polarity
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-I7 Recognize and explain marking welds and material types, including their characteristics and applications.

WEL-12A-I7-1 Identify various **material types**, including
- ferrous
- non-ferrous

WEL-12A-I7-2 Describe various **material types**, including
- selection of the appropriate material type
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-I7-3 Recognize various **identification markings**, including
- heat numbers
- grain direction
- lot and job numbers
- material grade

WEL-12A-I7-4 Explain various **identification markings**, including
- selection of the appropriate identification markings
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-I7-5 Recognize various **marking devices**, such as
- paint markers
- soapstone

- chalk
- steel stamps
- tagging systems
- laser markers

WEL-12A-I7-6 Explain various **marking devices,** including

- selection of the appropriate marking devices
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-I7-7 Recognize various **personalized welder identifications**, including

- initials
- numbers

WEL-12A-I7-8 Explain various **personalized welder identifications**, including

- selection of the appropriate personalized welder identifications
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-I9 Recognize and explain final product finishing, including its characteristics and applications.

WEL-12A-I9-1 Recognize various **tools and equipment** related to final product finishing, including

- grinders
- wire wheels
- buffers

WEL-12A-I9-2 Explain various **tools and equipment** related to final product finishing, including

- selection of the appropriate finishing tools and equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-I9-3 Recognize various **weld discontinuities** related to final product finishing, including

- porosity
- undercut
- cold lap
- excess or incomplete penetration

WEL-12A-I9-4 Explain various **weld discontinuities** related to final product finishing, including

- their identification
- their characteristics
- their effects on the final product
- correction of weld discontinuities on the final product finishing

WEL-12A-I9-5 Recognize various **undesirable materials** related to final product finishing, including

- oils
- oxides

WEL-12A-I9-6 Explain various **undesirable materials** related to final product finishing, including

- their identification
- their characteristics
- their effects on the final product
- correction of undesirable materials on the final product finishing

WEL-12A-I9-7 Recognize various **surface imperfections** related to final product finishing, including

- welding spatter
- gouges
- stray arc strikes
- sharp edges
- plate clamp gouges
- miscellaneous defects

WEL-12A-I9-8 Explain various **surface imperfections** related to final product finishing, including

- their identification
- their characteristics
- their effects on the final product
- correction of surface imperfections on the final product finishing

WEL-12A-I9-9 Recognize various **specific finishes** related to final product finishing, including

- coatings
- pickling
- machining
- blasting

WEL-12A-I9-10 Explain various **specific finishes** related to final product finishing, including

- selection of the appropriate product finish
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-I10 Recognize and explain quality inspections, including their characteristics and applications.

WEL-12A-I10-1 Recognize various quality inspection **tools and equipment**, including

- magnifying lenses
- inspection mirrors
- flashlights

WEL-12A-I10-2 Explain various quality inspection **tools and equipment**, including

- selection of the appropriate quality inspection tools and equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-I10-3 Recognize various quality inspection **measuring devices**, including

- fillet weld gauge
- depth gauge
- hi-lo gauge
- bridge cam gauge
- steel rulers

WEL-12A-I10-4 Explain various quality inspection **measuring devices**, including

- selection of the appropriate quality inspection measuring devices
- characteristics and key features

- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-I10-5 Recognize various quality inspection **material defects**, including

- surface irregularities
- laminations
- surface contamination

WEL-12A-I10-6 Explain various quality inspection **material defects**, including

- their identification
- their characteristics
- their effects on the final product
- correction of material defects

WEL-12A-I10-7 Recognize various quality inspection **fabrication defects**, including

- improper fit-up
- misalignment
- distortion
- incorrect dimensions and orientation

WEL-12A-I10-8 Explain various quality inspection **fabrication defects**, including

- their identification
- their characteristics
- their effects on the final product
- correction of fabrication defects

WEL-12A-I10-9 Recognize various quality inspection **weld discontinuities**, including

- porosity
- undercut
- cold lap
- excess or incomplete penetration

WEL-12A-I10-10 Explain various quality inspection **weld discontinuities**, including

- their identification
- their characteristics
- their effects on the final product
- correction of weld discontinuities on the final product

WEL-12-I10-11 Identify various quality inspection **surface imperfections,** including

- welding spatter
- gouges
- stray arc strikes
- sharp edges

WEL-12-I10-12 Describe various quality inspection **surface imperfections**, including

- their identification
- their characteristics
- their effects on the final product
- correction of weld discontinuities on the final product

WEL-12A-I11 Demonstrate how to safely and properly use weld processes and quality inspections.

WEL-12-I11-1 Demonstrate how to safely and properly use weld processes and quality inspections.

Strand K: Layout and Fabrication (A10)

WEL-12A-K1 Recognize, explain, and demonstrate an understanding of terminology associated with layout and fabrication.

WEL-12A-K1-1 Recognize **key terms** and **names** associated with layout and fabrication.

WEL-12A-K1-2 Explain the **names** and **purposes** associated with layout and fabrication.

WEL-12A-K1-3 Demonstrate an understanding of the **names** and **purposes** associated with layout and fabrication.

WEL-12A-K2 Recognize the various hazards associated with layout and fabrication, and describe and demonstrate the related safe work practices.

WEL-12A-K2-1 Identify layout and fabrication **hazards**, and describe **safe work practices**, including

- pinch points
- debris
- cuts
- burns

WEL-12A-K2-2 Demonstrate **safe work practices** related to layout and fabrication.

WEL-12A-K5 Recognize, explain, and demonstrate preparing materials to fabricate components, including their selection, characteristics, applications, and procedures.

WEL-12A-K5-1 Recognize various types of base **metals** for welding.

WEL-12A-K5-2 Explain various types of base **metals** for welding, including

- selection of the appropriate base metals
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-K5-5 Recognize various tacking **methods** for welding, including pre-setting.

WEL-12A-K5-6 Explain various tacking **methods** for welding, including

- selection of the appropriate tacking methods
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-K5-7 Recognize various methods to control **expansion and contraction** for welding, including

- tacking sequence
- gussets
- strongbacks
- heat sinks

WEL-12A-K5-8 Explain various methods to control **expansion and contraction** for welding, including

- selection of the appropriate methods to control expansion and contraction
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-K6 Recognize and explain welding component assembly, including its selection, characteristics, applications, and procedures.

WEL-12A-K6-1 Recognize various welding **tools and equipment**, including

- hi-lo gauge
- jigs and fixtures

- clamps
- wedges
- alignment tools

WEL-12A-K6-2 Explain various welding **tools and equipment**, including
- selection of the appropriate welding tools and equipment
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-K6-3 Demonstrate how to safely and properly use various welding **tools and equipment**.

WEL-12A-K6-4 Recognize various welding assembly **constraints**, including
- building size
- equipment limitations

WEL-12A-K6-5 Explain various welding assembly **constraints**, including
- their identification
- their characteristics
- their effects on the final product
- correction of welding assembly constraints

WEL-12A-K6-6 Recognize various welding **assembly** sequences.

WEL-12A-K6-7 Explain various welding **assembly** sequences, including
- their development and how they are made
- selection of the appropriate welding assembly sequence
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-K6-8 Recognize various welding set **gaps and alignments**.

WEL-12A-K6-9 Explain various welding set **gaps and alignments**, including
- selection of the appropriate gaps and alignments
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-K6-10 Recognize various welding **fits, placements, and adjustment components**.

WEL-12A-K6-11 Explain various welding **fits, placements, and adjustment components**.

WEL-12A-K6-14 Recognize how to verify **assembly** throughout all stages.

WEL-12A-K6-15 Explain how to verify **assembly** throughout all stages.

WEL-12A-K7 Demonstrate and perform the procedures used to lay out and prepare components for welding.

WEL-12A-K7-1 Demonstrate various procedures used to lay out and prepare **components** for welding, including paper templates.

WEL-12A-K7-2 Demonstrate various procedures used to lay out and prepare **materials** for welding, including

- angle iron
- square tube

WEL-12A-K7-4 Demonstrate how to verify **assembly** throughout all stages.

Strand M: Semi-Automatic Wire Feed Welding (A12)

WEL-12A-M1 Recognize, explain, and demonstrate an understanding of terminology associated with semi-automatic wire feed welding processes.

WEL-12A-M1-1 Recognize the **key terms and names** associated with semi-automatic wire feed welding processes, including

- flux-cored arc welding (FCAW)
- metal-cored arc welding (MCAW)
- gas metal arc welding (GMAW)

WEL-12A-M1-2 Explain the **names and purposes** associated with semi-automatic wire feed welding processes, including

- flux-cored arc welding (FCAW)
- metal-cored arc welding (MCAW)
- gas metal arc welding (GMAW)

WEL-12A-M1-3 Demonstrate an understanding of the **names and purposes** associated with semi-automatic wire feed welding processes, including

- flux-cored arc welding (FCAW)
- metal-cored arc welding (MCAW)
- gas metal arc welding (GMAW)

WEL-12A-M2 Recognize the various hazards associated with semi-automatic wire feed welding, and explain and demonstrate the related safe work practices.

WEL-12A-M2-1 Recognize semi-automatic wire feed welding process **hazards** and explain **safe work practices**, including

- burns, electrical burns, and electrical shocks
- ultraviolet, infrared, and visible light rays
- asphyxiation, ozone, and phosgene gases
- pinch points, falling objects, and moving parts

WEL-12A-M2-2 Demonstrate safe work practices related to **semi-automatic wire feed welding** processes**.**

WEL-12A-M3 Interpret jurisdictional codes and regulations pertaining to semi-automatic wire feed welding.

WEL-12A-M3-1 Understand and follow the local rules and safety **standards** that apply to semi-automatic wire feed welding.

WEL-12A-M4 Recognize and explain equipment, components, shielding, and consumables for flux-cored arc welding (FCAW), metal-cored arc welding (MCAW), and gas metal arc welding (GMAW), including their characteristics, applications, and operation.

WEL-12A-M4-1 Recognize various equipment **power sources** for FCAW, MCAW, and GMAW, including

- constant voltage (CV) capable machines
- inverters
- rectifiers
- generators

WEL-12A-M4-2 Explain various equipment **power sources** for FCAW, MCAW, and GMAW, including

- selection of the appropriate power sources for FCAW, MCAW, and GMAW
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-M4-3 Recognize various equipment **components** for FCAW, MCAW, and GMAW, including

- air-cooled guns
- water-cooled guns
- nozzles
- contact tips

- wire feeders
- voltage sensing wire feeders
- drive rolls
- gas diffusers
- liners
- work lead clamps
- regulators/flow meters
- shielding gas lines

WEL-12A-M4-4 Explain various equipment **components** for FCAW, MCAW, and GMAW, including

- selection of the appropriate equipment components for FCAW, MCAW, and GMAW
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-M4-5 Recognize various **shielding gases** for FCAW, MCAW, and GMAW, including

- mixed gases
- carbon dioxide (CO_2)
- argon
- helium

WEL-12A-M4-6 Explain various **shielding gases** for FCAW, MCAW, and GMAW, including

- selection of the appropriate shielding gas for FCAW, MCAW, and GMAW
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-M4-7 Recognize various **wire types** for FCAW, MCAW, and GMAW, including

- solid
- tubular wire
- self-shielded

WEL-12A-M4-8 Explain various **wire types** for FCAW, MCAW, and GMAW, including

- selection of the appropriate wire type for FCAW, MCAW, and GMAW

- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance
- procedures for conducting a thorough inspection
- procedures for regular maintenance
- guidelines for proper storage

WEL-12A-M4-9 Recognize various **modes of transfer** for FCAW, MCAW, and GMAW, including

- short circuit
- globular
- spray
- pulse spray

WEL-12A-M4-10 Explain various **modes of transfer** for FCAW, MCAW, and GMAW, including

- selection of the appropriate mode of transfer for FCAW, MCAW, and GMAW
- characteristics and key features
- application (i.e., role or utility in specific scenarios)
- limitations in scope or performance

WEL-12A-M5 Explain and demonstrate the procedures to weld using flux-cored arc welding (FCAW), metal-cored arc welding (MCAW), and GMAW processes for horizontal groove (2G) and horizontal fillet (2F) applications.

WEL-12A-M5-1 Explain various FCAW, MCAW, and GMAW equipment and components, and demonstrate the procedures to follow **before operating**, including

- recognizing damage and defects
- required maintenance

WEL-12A-M5-2 Explain how to **set up** FCAW, MCAW, and GMAW equipment, and demonstrate the procedures to follow, including

- setting machine settings
- setting polarity
- assembling gun components and connecting to wire feeder
- connecting regulator to gas supply and gas hose to wire feeder
- installing wire roll in wire feeder
- feeding wire through drive rolls, liner, and gun
- clipping end of wire for stick-out
- adjusting wire drive roll tension

- attaching work lead clamp to base metal
- verifying setup

WEL-12A-M5-3 Explain how to set up FCAW, MCAW, and GMAW **operating parameters,** and demonstrate the procedures to follow, including

- determining parameters
- setting wire feed speed and voltage
- setting gas flow rate
- verifying setup

WEL-12A-M5-4 Explain and demonstrate the procedures to **preform welds** using GMAW processes for horizontal groove (2G) and horizontal fillet (2F) applications, including

- starting up equipment
- starting arc and manipulating electrode
- performing wire manipulation techniques
- performing tacking, backstepping, and sequencing techniques
- adjusting travel speed and angle
- stopping arc
- removing slag using tools
- recognizing weld discontinuities and defects
- determining cause of weld discontinuities and defects
- repairing weld discontinuities and defects
- restarting arc
- finishing weld
- shutting down equipment

WEL-12A-M5-5 Explain and demonstrate the procedures to **preform welds** using FCAW and MCAW processes for flat groove (1G) and flat fillet (1F) applications, including

- starting up equipment
- starting arc and manipulating electrode
- performing wire manipulation techniques
- performing tacking, backstepping, and sequencing techniques
- adjusting travel speed and angle
- stopping arc
- removing slag using tools
- recognizing weld discontinuities and defects
- determining cause of weld discontinuities and defects
- repairing weld discontinuities and defects

- restarting arc
- finishing weld
- shutting down equipment

WEL-12A-M6 Perform the procedures for semi-automatic wire feed welding.

WEL-12A-M6-1 Demonstrate the **procedures for flux-cored arc welding** (FCAW) or **metal-cored arc welding** (MCAW) semi-automatic wire feed welding, including

- E491T-9 (E71T-1) FCAW
- E49C-6 (E70C-6) MCAW
- diameter = 0.045

WEL-12A-M6-2 Demonstrate the **procedures for gas metal arc welding** (GMAW) semi-automatic wire feed welding, including

- fillet weld assembly all positions
- ER49S-6 (ER70S-6)
- diameter = 0.035

Curriculum Implementation Resources

Curriculum implementation resources are frequently added. Please refer to https://edu.gov.mb.ca/k12/framework/sytep/welding/resources/index.html.