Apprenticeship Manitoba

Manitoba

Welder
Level 1

06-2024

Apprenticeship Manitoba

Welder

Unit: A1 Learning About Work

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

A sign that an apprentice has become competent in a task or technique is their ability to share this knowledge. Worksite skills-exchange has long been fundamental to trade-learning. Even trade veterans rely on peers to refine their knowledge and skill. The opportunity to benefit from this process, however, is shaped by complex factors that include worksite 'politics' and job deadlines. As adult trade-learners, apprentices at all levels of training must use their observational, listening, and interpersonal skills to benefit from the journeyperson's knowledge and experience. This requires understanding the trade's dynamics, as well as the roles and responsibilities that determine work-life.

This unit profiles the trade's structure and scope as determined by The Apprenticeship and Certification Act, Apprenticeship and Certification Board, Sector Committees, and Industry Working Groups using the occupational standards from which the technical training is derived. This unit includes short- and long-term career progression and social competencies. The unit also includes information about major areas of working knowledge, activities and interactions at work, and expansive and restrictive workplaces, stressing their application to apprenticeship on-the-job training.

A sound grasp of the roles, workplace relationships, and possibilities introduced in this unit are part of 'learning to learn' in Manitoba's apprenticeship system. Senior apprentices are later offered information about the transfer of knowledge and skills in this system. Please refer to unit Journeyperson Trainer, which explores the central and time-honoured foundation of trades journeywork.

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a "Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe the structure and scope of the Welder trade.	**n/a**
a. The Apprenticeship and Certification Act • Apprenticeship and Certification Board • Sector Committees and Industry Working Groups (IWG) • General regulation, and specific trade regulations/by-laws • Policies regarding attendance, evaluation procedures, conduct, and progression requirements (Apprenticeship Manitoba, training provider)	
b. Uses of the Red Seal Occupational Standard (RSOS) • Apprenticeship Manitoba technical training standards • On-the-job report of hours • Examinations (unit tests, final certification examinations)	
c. Opportunities and future career options	

- Generalists and specialists. The move toward specialization is well known to modern tradespeople. Some prefer to specialize and others want to do it all. Supervisory positions require a broad scope.
- Lead hands and other immediate supervisors. Apprentices need to know how to become a lead-hand as much as they need to know the benefits and pit-falls of leadership between management, journeypersons, tradespersons, and other workers.
- Geographic mobility. What does it mean to a tradesperson to have to travel to find work? Are there more opportunities if they do? What are they? What are the drawbacks to being away from home for several weeks at a time?
- Job hierarchies and innovations. What trade specific special training opportunities are available in the trade? Is there travel involved? How do these opportunities affect work assignments and career progression?

2. Describe two levels of workplace competency. **n/a**

a. Job competencies related to workplace culture
   - Knowledge of workplace equipment and materials
   - Skills and techniques

b. Social competencies related to workplace culture
   - Language of work
   - Workplace belief systems
   - Rules and meanings
   - Equity, diversity, and inclusion in the workplace

3. Describe accommodation for apprentices with accessibility requirements. **n/a**

a. Awareness of the *Accessibility for Manitobans Act*
   - Customer service accessibility standard
   - Employment accessibility standard
   - Information and communications accessibility standard
   - Built environment
   - Transportation

b. Technical training
   - Requirements
   - Roles and responsibilities
   - Services and information required by persons with accessibility requirements

c. On-the-job
   - Requirements
   - Roles and responsibilities
   - Services and information required by persons with accessibility requirements

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Apprenticeship Manitoba

Welder

Unit: A2 Trade Safety Awareness

Level: One
Duration: 7 hours
Theory: 7 Hours
Practical: 0 Hours

Overview:

Safe working conditions, injury prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers, supervisors, and workers. It is imperative to be familiar with and apply the Manitoba Workplace Safety and Health Act and Regulations. Safety education is an integral part of apprenticeship training both in school and on-the-job. This unit is an overview of occupational safety and health best practices in Manitoba and covers Personal Protective Equipment, the Workplace Hazardous Materials Information System, and Safe Work Procedures. The unit also describes injury prevention and response. Finally, the unit reinforces these best practices by navigating the SAFE Work Manitoba website through each objective to apply Manitoba's most current safety and health standards. Additional trade safety awareness related resources are located on the Apprenticeship Manitoba website link below. Trade specific hazards and safe work practices are supplemented and delivered in-context within technical training units.

- **SAFE Work Manitoba website:** https://www.safemanitoba.com/
- **Safety resources:** https://www.gov.mb.ca/aesi/apprenticeship/generalinfo/instructoreducators.html

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a "Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content: **Percent of Unit Mark (%)**

1. Define and describe Manitoba safety and health requirements. **n/a**

a. Overview of the *Workplace Safety and Health Act and Regulations*
   - Rights and responsibilities of workers under the *Act*
   - Rights and responsibilities of supervisors under the *Act*
   - Rights and responsibilities of employers under the *Act*

b. Public agencies
   - Workplace Safety and Health (Enforcement)
   - SAFE Work Manitoba (Prevention)
   - Other

c. Codes of practice, guidelines, policies, and standards (differences)

d. Worker rights
   - Right to know, participate and refuse
   - Protection from reprisal

e. Workplace safety and health program (worker's involvement)
   - Workplace safety and health committee
   - Participation in investigation and inspection process

2. Identify and describe personal protective equipment (PPE) requirements and standards in the workplace. **n/a**

a. Employer, supervisor and worker responsibilities
b. Hierarchy of control measures
c. Personal protective equipment (PPE)
    - Eye and face protection
    - Hearing protection
    - Foot, head, hand and skin protection
    - Respiratory protection
    - Protective clothing (including Hi-Visibility/Hi-Vis)
    - Fall protection (trade specific)

3. Identify and describe the Workplace Hazardous Material Information System (WHMIS) and procedures. **n/a**

a. Hazard identification
b. Product labels, symbols and classification
    - Supplier
    - Workplace
c. Safety Data Sheets (SDS)
d. Chemical and biological hazards
    - Emergency washing
    - Transportation of dangerous goods
    - Storage and handling

4. Identify and describe Safe Work Procedures (SWP). **n/a**

a. Hazard identification
b. Uncontrolled risk
c. SWP development

5. Identify and describe injury prevention.

a. Hazard recognition, evaluation, and control (SAFE acronym)
b. Occupational disease and illness
c. Musculoskeletal
    - Ergonomics
d. Psychological health and safety
    - Harassment and violence
    - Working alone
e. Young workers
f. Physical hazards
g. Chemical and biological hazards and exposures
    - Dust and fibres
    - Fumes, aerosols, gases and vapours
h. Confined space entry
i. Electrical safety
    - Lockout/tagout procedures
j. Fire types, fire extinguisher classifications and applications

6. Identify and describe injury response. **n/a**

a. Control the scene
b. Incident investigation
    - Near miss
    - Incident
    - Serious incident

c. Corrective actions
d. Follow-up
e. Reporting an injury (Workers Compensation Board of Manitoba (WCB))

7. Demonstrate navigation and retrieval of key content areas from SAFE Work Manitoba's website and apply resources directly to unit objectives. **n/a**

a. Legislation
b. Bulletins
c. Templates
d. Shop talk
e. Other resources

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Apprenticeship Manitoba

Welder

Unit: A3 Tools and Equipment

Level: One
Duration: 21 hours
Theory: 14 hours
Practical: 7 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills associated with tools and equipment. Beginning with terminology and safe work practices, this unit will focus on tools and equipment, their selection, characteristics, applications and limitations. The unit covers non-thermal cutting and grinding consumables. The unit also covers the procedures to inspect, maintain and store tools and equipment. Apprentices will describe and demonstrate the procedures to cut with tools and equipment. Finally, apprentices will perform various practice activities using tools and equipment to increase awareness and better understand their safe work procedures.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with tools and equipment. a. Refer to Welder Red Seal Occupational Standard (RSOS)	**5%**
2. Identify hazards and describe safe work practices pertaining to tools and equipment. a. Noise, cuts and crush injuries b. Rotating equipment c. Flying debris	**5%**
3. Identify and describe tools and equipment, their selection, characteristics, applications and limitations. a. Layout and measuring tools b. Hand tools c. Portable power tools • Electric • Hydraulic • Pneumatic d. Non-thermal cutting and grinding tools e. Stationary power tools • Drill press • Band saw • Pedestal grinder • Power roller • Belt sander • Cold cut saw • Other	**30%**

f. Stationary Machinery
- Shear
- Ironworker
- Plate roller
- Pipe bender
- Press brake
- Other

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4. Identify and describe non-thermal cutting and grinding consumables and their selection, characteristics, applications and limitations. **15%**

a. Materials
- Carbon steel
- Stainless steel
- Aluminum
- High alloy

b. Types of disks and wheels
- Abrasive
- Composite
- Carbide
- Wire

c. Types of blades
- Cutting ferrous metals and non-ferrous metals
- Blade clearances, composition, and pitch
- Speed and direction

d. Types of cuts
- Straight
- Bevel
- Radius

e. Consumable selection considerations
- Grade and thickness of material
- Type of cut
- Size and cut finish
- Tool limitation

5. Describe the procedures used to inspect, maintain, and store tools and equipment. **10%**

a. Check accuracy and calibrate
b. Clean, lubricate and check hydraulic fluids
c. Ensure pneumatic air supply is dry and clean
d. Sharpen twist drill bits
e. Sharpen striking tools
f. Lock out/tag out and removal from service
g. Inspect safety guards, cords, switches, connectors and hoses

6. Describe and demonstrate the procedures to use and cut with tools and equipment. **25%**

a. Layout and measuring tools
b. Hand tools
c. Portable power tools
d. Non-thermal cutting and grinding tools
e. Stationary power tools
f. Stationary machinery

7. Perform various practice activities using tools and equipment to increase awareness and better understand their safe work procedures. **10%**

a. Layout and measuring tools
b. Hand tools
c. Portable power tools
d. Non-thermal cutting and grinding tools
e. Stationary power tools
f. Stationary machinery

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Apprenticeship Manitoba

Welder

Unit: A4 Trade Related Communications

Level: One
Duration: 14 hours
Theory: 14 hours
Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills required to elevate trade related communications. Beginning with the ability to recognize different learning styles and apply effective verbal and non-verbal communication practices, apprentices will describe how they are applied differently to multiple stakeholders. Apprentices will be introduced to fundamental Canadian human rights in the workplace as they interact with a variety of industry stakeholders by identifying the value of equity, diversity and inclusion in workplace as well as communication that constitutes bullying, harassment and discrimination. This unit continues to build on these face-to-face practices by applying learned techniques to various digital communication methods used on the worksite for tasks and directions. Finally, apprentices will perform these various communication skills while practicing active listening and response.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify and describe effective verbal and non-verbal communication practices. a. Other tradespeople b. Colleagues c. Apprentices d. Supervisors e. Clients f. Jurisdictional representatives g. Manufacturers	**15%**
2. Identify and describe learning styles. a. Visual b. Auditory c. Reading d. Writing e. Kinesthetic	**10%**
3. Identify workplace values and communication that constitutes bullying as defined by the Canadian Human Rights Act and jurisdictional human rights laws. a. Equity b. Diversity c. Inclusion d. Harassment e. Discrimination	**15%**

4. Apply communication techniques using electronic messages. **20%**

a. Emails
b. Text messages
c. Plain language and clear expressions
d. Professionalism

5. Demonstrate and perform effective communication skills and practice active listening and response. **40%**

a. Hearing
b. Interpreting
c. Reflecting
d. Responding (verbal)
e. Non-verbal (body language)
f. Paraphrasing
g. Asking questions
h. Accepting constructive feedback

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Apprenticeship Manitoba

Welder

Unit: A5 Trade Related Mathematics

Level: One
Duration: 28 hours
Theory: 28 hours
Practical: 0 hours

Overview:

This unit provides a review of foundational math concepts in the welder trade. The application of these concepts will help apprentices develop problem solving and critical thinking skills. Finally, this unit will prepare students to apply math concepts, problem solving and critical thinking skills to solve trade related problems in future units of technical training in the welder trade.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Solve trade related foundational math problems. a. Proper, improper, or mixed fractions b. Multiply, divide, reduce and expand common fractions c. Decimal and common fractions, standard operations and conversions d. Roots and exponents e. Order of operations f. Tolerances and margins of error g. Percentage	**20%**
2. Solve trade related problems between metric and customary measurement systems. a. Linear measures b. Conversion factors	**20%**
3. Solve trade related problems using calculations for simple and complex geometric shapes. a. Perimeter and area of polygons • Triangle • Rectangle • Compound shapes b. Pythagorean theorem c. Volume • Cylinder d. Circles • Circumference • Area e. Angles • Complementary	**25%**

- Supplementary
- Angle measurement

f. Chord lengths

4. Solve trade related problems using ratio and proportion. 25%

a. Direct
b. Indirect

5. Solve trade related algebraic problems involving simple equations and formulas. 10%

a. Manipulate equations
b. Isolate variables
c. Create simple equations

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Apprenticeship Manitoba

Welder

Unit: A6 Material Handling and Access Equipment

Level: One
Duration: 14 hours
Theory: 7 hours
Practical: 7 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills related to material handling and access equipment. Beginning with terminology and safe work practices, this unit will focus on lifting, rigging and hoisting equipment, their characteristics, application and operation. The unit also covers standard hand signals, slings, rigging methods and devices. Finally, apprentices will describe and demonstrate the procedures to inspect, maintain and use material handling and access equipment.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with material handling. a. Refer to Welder Red Seal Occupational Standard (RSOS)	**5%**
2. Identify hazards and describe safe work practices of material handling. a. Lifting, rigging and hoisting • Falls • Overhead and electrical power lines • Pinch/crush points • Surrounding area and lift conditions • Property and equipment damage b. Ladders • 3-point contact and slope • Load capacity label • Access and egress	**10%**
3. Interpret jurisdictional regulation and manufacturers' specifications pertaining to material handling.	**5%**
4. Identify and describe lifting, rigging and hoisting equipment, and their characteristics, application and operation. a. Standard crane and hoist hand signals b. Rigging devices • Beam clamps • Tag lines • Spreader bars • Load softeners • Plate clamps	**30%**

c. Rigging methods
   - Chokers
   - Basket hitches
   - Vertical hitch
   - Sling angles

d. Slings
   - Types
   - Working Load Limits (WLL)

5. Identify and describe material handling and access equipment, their characteristics, application and operation. **20%**

a. Material handling equipment
   - Rigging equipment
   - Hoisting and lifting equipment
   - Chain falls
   - Overhead and mobile cranes

b. Access equipment
   - Fall arrest harnesses
   - Anchor points
   - Ladders
   - Scaffolding
   - Aerial work platforms

6. Describe and demonstrate the procedures to select, maintain and use lifting, rigging and hoisting equipment. **30%**

a. Select and inspect material handling equipment
   - Rigging, hoisting and lifting equipment

b. Calculate load dimensions and weight
   - Material type, shape and size

c. Calculate sling angles
   - Load chart

d. Plan lift and path of travel and confirm lay down area
e. Cordon off work area
f. Secure rigging to objects
   - Single choker
   - Double wrap choker
   - Basket

g. Place and use tag lines
h. Perform and interpret hand signals
i. Transfer and monitor load
j. Place load in pre-selected area using dunnage and softeners
k. Store material handling equipment

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Apprenticeship Manitoba

Welder

Unit: A7 Drawings and Welding Symbols

Level: One
Duration: 21 hours
Theory: 21 hours
Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills associated with welding drawings and symbols. Beginning with terminology, the unit focuses on drawings and welding symbols. The unit also covers organizing materials. Finally, apprentices will interpret drawings and welding symbols, and perform material take-off using various types of drawings to extract information.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with drawings and welding symbols.	**5%**
a. Refer to Welder Red Seal Occupational Standard (RSOS)	
2. Identify and describe the use of drawings and welding symbols.	**30%**

a. Blueprints
- Assembly drawings
- Shop and fabrication drawings
- Site drawings
- Engineered drawings

b. Views
- Section
- Detail
- Orthographic
- Isometric

c. Documentation
- Codes
- Specifications
- Change orders
- Request for information (RFI)

d. Drawing conventions
- Alphabet of lines
- Reference numbers, symbols and abbreviations
- Units of measurement (metric/imperial)
- Scaling
- Title block and legend
- Notes, specifications and schedules

e. Welding symbols
    - Type of weld
    - Type of joints
    - Size of weld
    - Field or shop weld
    - Contour symbols
    - Finish symbols
    - Reference line, arrow and tail
    - Backing

3. Identify and describe organizing materials, their characteristics, applications and procedures. **15%**

a. Material types
    - Bar stock, plates and beams
    - Pipe and tubing
    - Flanges and elbows
b. Gather materials
    - Cut list
    - Parts list
    - Metal ID tags
    - Job specifications
c. Verify bill of materials
    - Heat numbers
    - Drawings and specifications
    - Origin and traceability
d. Document use of inventory
e. Complete order sheet for out-of-stock materials
f. Queue and orientate materials
    - Sequence of assembly
g. Protect materials from damage using coverings
    - Sheathing
    - Cardboard
    - Blankets

4. Interpret drawings and welding symbols. **20%**

a. Drawings
    - Assembly drawings
    - Shop and fabrication drawings
    - Site drawings
b. Welding symbols
    - Types
    - Location
    - Information (tail at end of reference line)
    - Sequence
    - Other

5. Perform welding take-off using various types of drawings to interpret and extract information. **30%**

a. Identify quantities
b. Identify materials
    - Type
    - Thickness
c. Identify weld requirements

- Welding symbols
- Weld position
- Filler or electrode

d. Generate cut list

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Apprenticeship Manitoba

Welder

Unit: A8 Weld Process and Quality Inspection I

Level: One
Duration: 14 hours
Theory: 14 hours
Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills of weld process and quality inspection. Beginning with terminology and safe work practices, the unit will focus on the welding process selection and application. The unit covers gas cylinders, welding consumables, marking welds, materials and parts. The unit also covers controlling temperature of weldments and the final finishing of parts. Finally, apprentices will describe quality inspection, their characteristics and applications.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with weld process and quality inspection. a. Refer to Welder Red Seal Occupational Standard (RSOS)	**5%**
2. Identify hazards and describe safe work practices of weld process and quality inspection. a. Welding consumables • Burns, lifting and flux dust b. Gas cylinder hazards • Safety data sheets (SDS) • Explosions • Displacement of oxygen (asphyxiation) c. Final product finishing • Cuts and particulate projection/sparks • Dust/particulate inhalation and toxic chemicals d. Controls temperature of weldments • Electrical shocks and burns	**5%**
3. Interpret jurisdictional codes, regulations and job specifications pertaining to weld process and quality inspection.	**5%**
4. Identify and describe welding consumables, gas cylinders, and their characteristics and applications and storage. a. Welding consumables • Electrodes • Welding wires • Welding fluxes b. Gas cylinder product type and identification	**15%**

- Fuel
- Oxygen
- Inert
- Active

5. Identify and describe welding process, their selection, characteristics and applications. **10%**

a. Welding process
   - Shielded metal arc welding (SMAW)
   - Flux cored arc welding (FCAW)
   - Metal cored arc welding (MCAW)
   - Gas metal arc welding (GMAW)
   - Gas tungsten arc welding (GTAW)
   - Submerged arc welding (SAW)

b. Power source

c. Polarity

6. Identify and describe marking welds, materials, parts and their characteristics and applications. **15%**

a. Material types
   - Ferrous
   - Non-ferrous

b. Identification markings
   - Heat numbers
   - Grain direction
   - Lot and job numbers
   - Material grade

c. Marking devices

d. Personalized welder identifications
   - Initials
   - Numbers

e. Other methods to organize materials

7. Identify and describe controlling temperature of weldments. **15%**

a. Tools and equipment
   - Insulation
   - Heating tip (rose bud)
   - Heavy duty propane torch (tiger torch),
   - Induction heating coils
   - Ovens

b. Temperature measuring devices
   - Temperature sticks
   - Thermocouples
   - Pyrometers

8. Identify and describe final product finishing and their characteristics and applications. **15%**

a. Tools and equipment
   - Grinders
   - Wire wheels
   - Buffers

b. Weld discontinuities
   - Porosity

- Undercut
- Cold lap
- Excess or incomplete penetration

c. Undesirable materials
- Oils
- Oxides

d. Surface imperfections
- Welding spatter
- Gouges
- Stray arc strikes
- Sharp edges
- Plate clamp gouges
- Miscellaneous defects

e. Specific finishes
- Coatings
- Pickling
- Machining
- Blasting

9. Identify and describe quality inspection, their characteristics and applications. 15%

a. Tools and equipment
- Magnifying lenses
- Inspection mirrors
- Flashlights

b. Measuring devices
- Fillet weld gauge
- Depth gauge
- Hi-lo gauge
- Bridge cam gauge
- Steel rulers

c. Material defects
- Surface irregularities
- Laminations
- Surface contamination

d. Fabrication defects
- Improper fit-up
- Misalignment
- Distortion
- Incorrect dimensions and orientation

e. Weld discontinuities
- Porosity
- Undercut
- Cold lap
- Excess or incomplete penetration

f. Surface imperfections
- Welding spatter
- Gouges
- Stray arc strikes
- Sharp edges

g. Non-destructive testing
- Radiography
- Ultrasonic

- Liquid penetrant
- Magnetic particle examination
- Hydro
- Phased array

h. Destructive testing
   - Bend and tensile strength
   - Etching
   - Impact
   - Hardness

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Apprenticeship Manitoba

Welder

Unit: A9 Thermal Cutting and Gouging

Level: One
Duration: 28 hours
Theory: 14 hours
Practical: 14 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills of thermal cutting and gouging. Beginning with terminology and safe work practices, the unit covers oxy-fuel gas cutting, plasma arc cutting and air carbon arc cutting and gouging. The unit also covers their equipment, consumables, and their characteristics, applications and operation. Apprentices will describe and demonstrate the procedures for these thermal processes. Finally, apprentices will perform oxy-fuel gas cutting, plasma arc cutting and air carbon arc cutting and gouging.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with thermal cutting and gouging.	**5%**
a. Refer to Welder Red Seal Occupational Standard (RSOS)	
2. Identify hazards and describe safe work practices for thermal cutting and gouging.	**5%**
a. Oxy-fuel gas cutting (OFC) process • Fumes, sparks, burns and eye hazards • High pressure cylinders, maximum safe working pressures • Regulator blow-outs and critical explosion level	
b. Plasma arc cutting (PAC) process • Fumes, burns and noise • Electrical shocks, sparks and radiation	
c. Air carbon arc cutting and gouging (CAC-A) process • Fumes, sparks, burns and noise • Electrical shocks, radiation and molten material	
3. Identify and describe oxy-fuel gas cutting (OFC) equipment.	**10%**
a. Base metals and metallurgy	
b. Types of regulators • Single-stage and two-stage • Low-pressure and high-pressure	
c. Types of oxy-fuel gasses • Acetylene • Oxygen • Natural gas • Propane	
d. Oxygen and high-pressure fuel cylinders	

e. Types of flames
   - Neutral
   - Carburizing
   - Oxidizing
f. Torch components
   - Torch bodies
   - Hoses
   - Tips
   - Flashback arrestors
   - Reverse flow check valves
g. Manual and mechanized torch cutting systems
   - Bevellers
   - Track cutters
h. Factors of oxy-fuel cutting and gouging
   - Heat input
   - Base metal and thickness
i. Limitations of oxy-fuel cutting and gouging

4. Describe and demonstrate the procedures to cut and gouge using oxy-fuel cutting (OFC) processes. **10%**

a. Start-up equipment
b. Ignite fuel gas and adjust torch valves
   - According to type of flame
c. Pre-heat material to kindling point
   - To initiate cut
d. Perform cut
e. Identify and correct defects
f. Adjust and maintain travel speed and torch angle
g. Identify and correct backfire and flashback conditions
h. Shut down equipment
   - Purge

5. Identify and describe plasma arc cutting (PAC) equipment, components and consumables. **10%**

a. Equipment
   - Power source
   - Track and pipe beveling cutters
   - Manual
   - Semi-automatic
   - Automatic
   - Shields
   - Compressor
b. Components
   - Heat shield
   - Torch bodies
   - Hoses
   - Work lead clamp
c. Consumables
   - Electrodes
   - Constricting nozzles (tips)
   - Coolant level for liquid-cooled equipment
d. Compressed air
   - Driers

- Filters

e. Cutting aids
   - Stand-off
   - Circle cutting attachments
   - Drag nozzle

6. Describe and demonstrate the procedures to cut and gouge using plasma arc cutting (PAC) processes. **10%**

a. Set-up equipment
   - Visually inspect for damage
   - Assemble consumables on torch head
   - Connect torch to power source
   - Set up regulator
   - Attach work lead clamp to base metal
   - Adjust power supply

b. Set operating parameters
   - Amperage
   - Air pressure
   - Travel speed
   - Verify for cut defects

c. Perform cutting and gouging
   - Start-up equipment
   - Maintain travel speed and torch angle

d. Cutting techniques
   - Initiating the arc and cut
   - Starting at the correct stand-off distance

e. Diagnose malfunctions
   - Low air pressure
   - Poor work lead connection

7. Identify and describe air carbon cutting (CAC-A) equipment, consumables and their characteristics, applications and operation. **10%**

a. Equipment
   - Power source
   - Current type
   - Duty cycle
   - Compressor

b. Components
   - Hoses
   - Electrode holder
   - Cables
   - Work lead clamp

c. Carbon electrodes
   - Coated
   - Non-coated
   - Flat
   - Round
   - Half-round
   - Alternating current (AC),
   - Direct current (DC)

d. Defects
   - Copper and carbon deposits
   - Poor gouge quality

e. Cutting application
   - Depth and width of gouge
   - Removing material

8. Describe and demonstrate the procedures to cut and gouge using air carbon cutting (CAC-A) processes. **10%**

a. Set-up equipment
   - Visually inspect for damage
   - Attach components to power source
   - Attach components to air supply
   - Attach work lead clamp to base metal

b. Set operating parameters
   - Set amperage
   - Adjust regulator
   - Verify operating parameters and electrode selection

c. Perform cutting and gouging
   - Start-up CAC-A equipment
   - Insert electrode into holder
   - Maintain electrode to work angle
   - Adjust carbon electrode stick-out during use
   - Maintain travel speed
   - Identify defects after gouging
   - Clean material
   - Shut down equipment

9. Perform the procedures to cut and gouge using thermal processes. **30%**

a. Oxy-fuel gas cutting (OFC)
   - Straight cuts
   - Circular cuts
   - Bevel cuts
   - Internal shaped cuts

b. Plasma arc cutting (PAC)
   - Straight cuts
   - Circular cuts
   - Bevel cuts
   - Internal shaped cuts

c. Air carbon arc cutting (CAC-A)
   - Remove welds
   - Gouge practice plates
   - Gouge and remove backing plates

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Apprenticeship Manitoba

Welder

Unit: A10 Layout and Fabrication I

Level: One
Duration: 28 hours
Theory: 14 hours
Practical: 14 hours

Overview:

This unit is designed to provide the apprentice with introductory knowledge and skills of layout and fabrication. Beginning with terminology and safe work practices, the unit covers template development and transferring dimensions from drawings to materials. The unit will also cover preparing materials to fabricate, fit and assemble components. Finally, apprentices will demonstrate and perform the procedures used to layout and prepare components for welding.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with layout and fabrication.	**5%**
a. Refer to Welder Red Seal Occupational Standard (RSOS)	
2. Identify hazards and describe safe work practices with layout and fabrication.	**5%**
a. Pinch points, debris, cuts and burns	
3. Identify and describe template development, transferring dimensions from drawings to materials, their selection, characteristics, applications and procedures.	**20%**
a. Measuring and layout tools	
b. Template materials	
• Metal, wood, cardboard, and paper	
• Fire resistance and durability	
c. Types of templates	
• Hole-punching templates	
• Wrap arounds	
• Cutting templates	
• Arc templates (sweeps)	
d. Template information	
• Part numbers	
• Layout information	
• Material required	
e. Starting point, working point and axis	
• Centre lines	
• Hole locations	
f. Transfer basic dimensions from drawing to template	

4. Identify and describe preparing materials to fabricate components, their selection, characteristics, applications and procedures. **15%**

a. Material type
b. Tools and equipment
c. Digital layout tools
   - Calipers
   - Levels
   - Measuring devices
d. Preparation process
   - Drill
   - Punch
   - Form
   - Grind
   - Thermal process
e. Prepare weld area
f. Prepare edge for assembly
   - Square
   - Bevel
   - Other
g. Cleaning process abrasive techniques
   - Grind
   - Sand
   - Wire wheel
   - File
   - Chemical

5. Identify and describe fitting components for welding, their characteristics, applications and procedures. **15%**

a. Types of base metals
b. Pre-heating requirements
c. Tacking methods
   - Pre-setting
d. Methods to control expansion and contraction
   - Tacking sequence
   - Gussets
   - Strongbacks
   - Heat sinks

6. Identify and describe welding component assembly, their selection, characteristics, applications and procedures. **15%**

a. Tools and equipment
   - Hi-lo gauge
   - Jigs and fixtures
   - Clamps
   - Wedges
   - Alignment tools
b. Assembly constraints
   - Building size
   - Equipment limitations
c. Assembly sequence
d. Set gaps and alignments
e. Fit, place and adjust components
f. Fasten components

- Bolts
- Clips

g. Verify assembly throughout all stages

6. Demonstrate and perform the procedures used to layout and prepare components for welding. **25%**

a. Layout
- Paper template

b. Materials
- Angle iron
- Square tube

c. Fabrication
- Mitre cut
- Fit
- Square
- Tack
- Quality control

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Apprenticeship Manitoba

Welder

Unit: A11 Shielded Metal Arc Welding I

Level: One
Duration: 63 hours
Theory: 14 hours
Practical: 49 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills of shielded metal arc welding (SMAW). Beginning with terminology, hazards and safe work practices, the unit covers SMAW weld types, positions, joint configurations, welding equipment and consumables. The unit also covers SMAW set up but will focus on the procedures, principles and techniques for flat (1G) applications. Finally, apprentices will perform the procedures for SMAW.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with shielded metal arc welding (SMAW). a. Refer to Welder Red Seal Occupational Standard (RSOS)	**5%**
2. Identify hazards and describe safe work practices of SMAW. a. Fumes, electrical shocks, burns and flying debris b. Visible light rays, ultraviolet (UV) and infrared light c. Falling objects, falling hazards and fire hazards d. Setting equipment operating parameters	**5%**
3. Interpret codes, standards, regulations and apply welding symbols and information pertaining to SMAW.	**5%**
4. Identify and describe SMAW welds. a. Weld types • Fillet • Groove • Plug • Slot • Surfacing b. Weld positions • Flat • Horizontal • Vertical-up • Vertical-down • Overhead c. Joint configurations • Butt	**10%**

- Tee
- Edge
- Corner
- Lap

5. Identify and describe SMAW welding equipment, consumables and their characteristics and applications. **15%**

a. Equipment
   - Operating principals
   - Machine options: arc force and hot start
   - Process fundamentals

b. Components
   - Work lead clamps and electrode holders
   - Cables and remote controls
   - Polarity

c. Power sources
   - Constant current (CC)
   - Inverters, rectifiers, generators and transformers
   - Duty cycle and amperage

d. Base metals
   - Ferrous and non-ferrous metals
   - Materials that can and cannot be welded

e. Electrodes / welding rods
   - Position
   - Tensile strength
   - Flux coating composition
   - F-numbers
   - Metric and imperial electrode designations
   - Storage

6. Describe and demonstrate procedures to set up SMAW equipment for flat (1G) applications. **15%**

a. Determine parameters
   - WPS/WPDS and application

b. Select machine settings
   - Polarity

c. Adjust amperage
   - Base metal thickness
   - Electrode type and size

d. Connect electrode holders and work lead clamps

e. Attach work lead clamp to base metal

f. Verify set up
   - Weld test piece of same base metal, electrode and position

7. Describe and demonstrate the procedures for SMAW for flat (1G) applications. **15%**

a. Electrode manipulation techniques
   - Whip
   - Backhand and forehand
   - Weave
   - Stringer

b. Maintain travel speed, electrode angle and heat inputs

c. Repair weld discontinuities and defects

8. Perform the procedures for SMAW. **30%**

a. Fillet weld assembly
   - Mild steel
   - All positions
   - E-4918 (E-7018)

b. Groove weld assembly
   - Mild steel
   - 1G
   - E-4310 (E-6010) root
   - E-4918 (E-7018) hotpass, fill and cap

c. Groove fillet weld assembly
   - Mild steel
   - 1GF
   - E-4918 (E-7018)

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Apprenticeship Manitoba

Welder

Unit: A12 Semi-Automatic Wire Feed Welding I

Level: One
Duration: 63 hours
Theory: 14 hours
Practical: 49 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills of semi-automatic wire feed welding. Beginning with terminology, hazards and safe work practices, the unit covers equipment, components, shielding and consumables for FCAW, MCAW, GMAW and their characteristics, applications and operation. The unit also covers procedures to weld using FCAW, MCAW and GMAW processes for flat (1G) applications. Finally, apprentices will perform the procedures for semi-automatic wire feed welding.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with semi-automatic wire feed welding processes. a. Refer to Welder Red Seal Occupational Standard (RSOS) b. Flux core arc welding (FCAW) c. Metal core arc welding (MCAW) d. Gas metal arc welding (GMAW)	**5%**
2. Identify hazards and describe safe work practices of semi-automatic wire feed welding. a. Burns, electrical burns and electrical shocks b. Ultra violet, infrared, and visible light rays c. Asphyxiation, ozone and phosgene gases d. Pinch points, falling objects and moving parts	**5%**
3. Interpret jurisdictional codes and regulations pertaining to semi-automatic wire feed welding.	**5%**
4. Identify and describe equipment, components, shielding and consumables for FCAW, MCAW, GMAW and their characteristics and applications and operation. a. Power source • Constant voltage (CV) capable machines • Inverters • Rectifiers • Generators b. Components • Air-cooled guns • Water-cooled guns • Nozzles	**25%**

- Contact tips
- Wire feeders
- Voltage sensing wire feeders
- Drive rolls
- Gas diffusers
- Liners
- Work lead clamps
- Regulators/flow meters
- Shielding gas lines

c. Shielding gas
- Mixed gases
- CO_2
- Argon
- Helium

d. Wire type
- Solid
- Tubular wire
- Self-shielded

e. Mode of transfer
- Short circuit
- Globular
- Spray
- Pulse spray

5. Describe and demonstrate the procedures to weld using FCAW, MCAW and GMAW processes for flat (1G) applications. 25%

a. FCAW, MCAW and GMAW equipment and components
- Identify damage and defects
- Required maintenance

b. Set-up equipment
- Set machine settings
- Set polarity
- Assemble gun components and connect to wire feeder
- Connect regulator to gas supply and gas hose to wire feeder
- Install wire roll in wire feeder
- Feed wire through drive rolls, liner and gun
- Clip end of wire for stick-out
- Adjust wire drive roll tension
- Attach work lead clamp to base metal
- Verify setup

c. Set operating parameters
- Determine parameters
- Set wire feed speed and voltage
- Set gas flow rate
- Verify setup

d. Performs welds
- Start-up equipment
- Start arc and manipulate electrode
- Perform wire manipulation techniques
- Perform tacking, backstepping and sequencing techniques
- Adjust travel speed and angle
- Stop arc

- Remove slag using tools
- Identify weld discontinuities and defects
- Determine cause of weld discontinuities and defects
- Repair weld discontinuities and defects
- Re-start arc
- Finish weld
- Shut down equipment

6. Perform the procedures for semi-automatic wire feed welding. 35%

a. FCAW or MCAW (Choice)
- Fillet weld assembly all positions
- Groove weld assembly 1G
- Groove fillet weld assembly 1GF
- E491T-9 (E71T-1) FCAW
- E49C-6 (E70C-6) MCAW
- Diameter = 0.045

b. GMAW
- Fillet weld assembly all positions
- Groove weld assembly 1G
- Groove fillet weld assembly 1GF
- ER49S-6 (ER70S-6)
- Diameter = 0.035

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Apprenticeship Manitoba

Welder

Unit: A13 Welder Practical Examination I

Level: One
Duration: 7 hours
Theory: 0 hours
Practical: 7 hours

Overview:

This unit is designed to verify required weld competency as part of the Manitoba welder practical examination. These required welds will be performed during Level 1 technical training to meet or exceed industry standards and national welding benchmarks. All individual processes below are pass/fail. All objectives must be passed to achieve a unit pass during technical training. Successful completion of this unit and the unique welding operations are a requirement for progression to the next level of technical training.

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a "Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Perform cuts welds using oxi-acetylene process.	**n/a**
a. Mild steel test plate • 100mm x 125mm x 10mm b. Freehand straight angled cut • 30° angle of cut c. Freehand circular cut • Locate hole position • 90° cut • To accept 25mm round bar d. Freehand coping cut • To accept a 100mm channel e. Follow provided drawing and specifications f. Testing procedure • Visual examination	
2. Perform groove weld assembly using shielded metal arc welding (SMAW).	**n/a**
a. Groove weld assembly • Mild steel b. Weld position • 1G c. Electrode • E-4310 (E-6010) root • E-4918 (E-7018) hotpass, fill and cap d. Follow provided drawing and specifications	

e. Testing procedure
   - Visual examination
   - Destructive bend test

3. Perform groove fillet weld assembly using gas metal arc welding (GMAW). n/a

a. Base metal
   - Mild steel plate
b. Weld position
   - 1GF
c. Wire
   - ER49S (ER70S)
   - Diameter = 0.035
d. Follow provided drawing and specifications
e. Testing procedure
   - Visual examination
   - Destructive bend test

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