Apprenticeship Manitoba

Manitoba

Sheet Metal Worker
Level 2

Rev. October 2018

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B1 Welding 2 (GMAW and SMAW)

Level: Two

Duration: 25 hours

Theory: 5 hours

Practical: 20 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of the procedures used to weld aluminum and stainless steel using the gas metal arc welding (GMAW) process, and of the shielded metal arc welding (SMAW) process, its applications, maintenance and procedures for use, and of weld defects, their causes and the procedures used to prevent and correct them. This unit also serves as a review and continuation of the content in *Welding 1* in Level One.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with GMAW and SMAW.	**5%**
2. Describe the GMAW and SMAW processes and their applications.	**5%**
3. Identify types of GMAW and SMAW equipment, consumables and accessories used to weld mild steel, aluminum and stainless steel, and describe their characteristics and applications, limitations and procedures for use.	**10%**
4. Identify hazards and describe safe work practices and procedures pertaining to the use of GMAW and SMAW equipment. a. Personal b. Shop/facility c. Equipment d. Ventilation e. Hot work	**10%**
5. Describe the procedures to set-up, adjust and shut-down GMAW and SMAW equipment.	**10%**
6. Identify the types of welds performed using the GMAW and SMAW processes. a. Plug b. Fillet (continuous) c. Stitch d. Tack e. Edge f. Corner	**10%**

7.	**Describe the procedures used to maintain and troubleshoot GMAW and SMAW equipment.**	**10%**
8.	**Interpret symbols and information pertaining to GMAW and SMAW welding found on drawings and specifications.**	**5%**
9.	**Describe weld defects, their causes and the procedures used to prevent and correct them.**	**5%**
10.	**Describe the procedures used to weld various materials using the GMAW and SMAW processes.**	**5%**
11.	**Demonstrate the ability to weld using GMAW and SMAW processes.**	**25%**

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B2 Trade Mathematics 2

Level: Two

Duration: 22 hours

Theory:	22	hours
Practical:	0	hours

Overview:

This unit is designed to provide the apprentice with the knowledge to use mathematics for workplace applications. This unit builds on the course Trade Mathematics 1 and is intended to provide the apprenticeship with opportunity to build on general mathematical concepts. The unit covers trade-related calculations for occupational skills. This unit also serves as a review and continuation of the content in *Trade Math 1* in Level One.

Objectives and Content:		Percent of Unit Mark (%)
1.	**Review general math concepts related to average and percentage.**	**20%**
2.	**Review general math concepts related to costs and wages.**	**20%**
3.	**Review general math concepts related to equations.**	**20%**
4.	**Review general math concepts related to ratio and proportion.**	**20%**
5.	**Demonstrate general math concepts as specified by instructor.**	**20%**

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B3 Science 1

Level: Two

Duration: 14 hours

Theory: 14 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge to use science for workplace applications. The unit covers a review of general science concepts including an overview of trade-related science.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Review science concepts of thermodynamics and heat.	**30%**
a. Thermodynamics	
b. First law of thermodynamics	
c. Second law of thermodynamics	
d. Temperature conversion	
e. Heat	
f. Heat measurement	
g. Heat transfer	
h. Heat production	
2. Review science concepts of combustion and fuels	**30%**
a. Combustion	
b. Fuels and heating values	
c. Combustion air	
d. Flames	
e. Products of combustion	
f. Combustion efficiency	
g. Electrical energy	
h. Electrical energy production	
i. Electricity	
3. Demonstrate science concepts as specified by instructor.	**40%**

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B4 Blueprint Reading/Specifications 1

Level: Two

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of blueprints and their applications in a residential context.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify the types of drawings and describe their applications.	**10%**
a. Civil/site b. Architectural c. Mechanical d. Structural e. Electrical f. Shop drawings g. Sketches h. As-built	
2. Identify the views used on blueprints.	**20%**
a. Elevation b. Plan c. Section d. Detail e. Auxiliary	
3. Identify the parts of a blueprint and describe their purpose and applications.	**20%**
a. Lines b. Legend c. Symbols and abbreviations • Duct • Welding • Electrical • Plumbing • Architectural d. Title block e. Notes and specifications	

4.	**Identify and interpret common symbols and abbreviations found on drawings, and extract information from them.**	**20%**
5.	**Identify the types of scales and describe their applications and procedures for use.**	**10%**
6.	**Describe metric and imperial systems of measurement.**	**10%**
7.	**Identify size and weight of equipment and materials to be supported according to manufacturers' specifications.**	**5%**
8.	**Lay out, fabricate and determine locations for the installation of sheet metal components from drawings.**	**5%**

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B5 Duct System Design 1

Level: Two
Duration: 38 hours
Theory: 28 hours
Practical: 10 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of duct systems and their associated design principles.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define and explain terminology associated with duct system design.	**5%**
2. Identify the types of basic duct systems and describe their associated design principles.	**5%**
3. Describe the procedures used to perform heat gain/loss calculations and their applications.	**5%**
4. Identify air patterns and describe their impact on the operation of duct systems.	**5%**
5. Identify air pressure and its impact on the operation of duct systems. a. Positive b. Negative	**10%**
6. Identify formulas used in duct system design and describe their applications. a. Fan laws b. Velocity c. Quantity d. Pressure	**15%**
7. Identify codes and regulations pertaining to basic design and field modifications.	**5%**
8. Identify considerations and requirements used to determine duct system design. a. Equal friction • Air duct calculator b. Static regain c. Constant velocity	**10%**

9. Conduct a heating and cooling system design project that includes: 40%

a. Heat load calculation
b. Equipment selection
c. Duct design
d. Material list
e. Labour estimate

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B6 Pattern Development 2

Level: Two

Duration: 44 hours

Theory: 20 hours

Practical: 24 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of parallel and radial line development and the triangulation method, their applications and associated calculations and the procedures used to develop and fabricate basic and advanced fittings using parallel and radial line development and the triangulation method. This unit serves as a review and continuation of content in *Pattern Development 1* in Level One.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define and explain terminology associated with parallel and radial line development and the triangulation method.	**10%**
2. Describe the types of fittings that require parallel and radial line development and the triangulation method. a. Parallel line development • Tee • Round elbow b. Radial line development • Right cone c. Triangulation method • Transitions • On-center • Square to round	**10%**
3. Identify and describe the calculations used in parallel and radial line development and the triangulation method and the procedures used to perform them.	**20%**

4. Describe the procedures used to develop and fabricate basic and advanced fittings using parallel and radial line development and the triangulation method. 20%

a. Determine views
b. Label lines and points
c. Prepare pattern
d. Determine true length of lines
e. Determine types of seams, joints and edges
f. Calculate allowances
g. Determine stretchouts
h. Confirm pattern accuracy
i. Cut pattern
j. Label pieces

5. Demonstrate the ability to perform parallel and radial line development and the triangulation method. 40%

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B7 Fabrication 2

Level: Two

Duration: 50 hours

Theory: 0 hours

Practical: 50 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge to form ductwork, fittings and flexible connectors for air handling systems. This unit also serves as a review and continuation of the content of *Fabrication 1* in Level One.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with forming ductwork, fittings and components. a. Turning vanes b. Splitter vanes c. Flex connectors d. Access doors	**5%**
2. Interpret information pertaining to the forming of ductwork, fittings and components found on drawings and specifications.	**5%**
3. Identify tools and equipment used to form ductwork, fittings and components and describe their applications, limitations and procedures for use.	**5%**
4. Identify considerations and requirements when forming ductwork, fittings and components for air and material handling systems. a. Load bearing capacities b. System specifications c. Environmental conditions	**5%**
5. Identify types of seams and joints for forming ductwork, fittings and components and describe the procedures used to produce them. a. Longitudinal b. Pittsburgh locks c. Groove seams d. Acme locks e. Snap/button locks f. Transverse g. Slip & drive	**5%**

h. TDC/TDF
i. Companion flanges

6. Identify types of edges for fabrication of ductwork and fittings, and describe the procedures used to produce them. **5%**

7. Identify types of fastening methods used to fabricate ductwork, fittings and components and describe their associated procedures. **5%**
a. Mechanical
b. Adhesives
c. Welding

8. Identify types of duct reinforcement. **5%**

9. Describe the procedures used to fabricate ductwork, fittings and components. **5%**

10. Identify hazards and describe safe work practices associated with forming ductwork, fittings and components. **5%**

11. Identify codes and regulations pertaining to the fabrication of sheet metal components. **5%**

12. Identify methods used to work with metals. **5%**
a. Forming
b. Cutting/shearing
c. Punching
d. Drilling
e. Joining
f. Soldering/brazing

13. Demonstrate the procedures to form ductwork, fittings and components for air handling systems. **40%**

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B8 Metal Roofing and Architectural Metal

Level: Two

Duration: 14 hours

Theory: 14 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of fabrication and installation procedures for metal roofing and architectural metals.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with metal roofing and architectural metals. a. Walls b. Insulation c. Isolation material d. Building envelope contents	**5%**
2. Identify tools and equipment used to fabricate and install metal roofing and architectural metals and describe their applications, limitations and procedures for use.	**5%**
3. Identify types of materials used in fabricating metal roofing and architectural metals. a. Types of metals b. Types of surface finishes • Mill • Brushed • Mirrored • Dull	**5%**
4. Identify types of components associated with metal roofing and architectural metals and describe their applications. a. Roof drainage b. Flashing c. Soffit and fascia d. Roof vents e. Wall panels f. Cladding/siding	**10%**
5. Describe the procedures used to fabricate metal roofing and architectural metals	**5%**

and their associated components.

a. Layout
b. Determine seam
c. Cut
d. Form

6. Identify considerations and requirements relating to fabricating, laying out and installing metal roofing and architectural metals. **10%**

a. Safety
b. Building materials
c. Codes and regulations
d. Roof slope
e. Expansion and contraction

7. Identify types of fasteners for installing metal roofing and architectural metals and describe their applications. **5%**

8. Identify types of roof structures and construction features and describe their applications. **5%**

a. Hip
b. Gable
c. Pitched
d. Flat

9. Describe the procedures used to layout metal roofing and architectural metals. **5%**

a. Check for square
b. Determine starting point
c. Establish reference lines

10. Identify materials to be installed to prepare surfaces for installation of metal roofing and architectural metals. **5%**

a. Insulation
b. Waterproof membrane
c. Isolation material
d. Building envelope

11. Describe the procedures used to install materials to roofs or walls in preparation for installation of metal roofing and architectural metals. **10%**

12. Describe the procedures used to install metal roofing and architectural metals. **10%**

a. Cut
b. Fit
c. Secure
d. Seal

13. Identify types of metal decking, fasteners, their associated tools and equipment, and describe the procedures used to install decking. **5%**

a. Metal pan
b. Q decking

14. Identify types of exterior components and describe their applications. **5%**

a. Awnings
b. Signage

15. Identify types of sealing and joining methods and the procedures to use them. 10%

a. Caulking
b. Soldering
c. Mastic
d. Butyl tape

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B9 Installation 2

Level: Two
Duration: 42 hours
Theory: 21 hours
Practical: 21 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge to conduct field measurements and prepare the site prior to installation of air and material handling systems. This unit also serves as a review and continuation of the content in *Installation 1* in Level One.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Identify, select and use measuring tools and equipment and describe their application, limitations and procedures for use.	**5%**
2. Identify types of obstructions that could prevent installation.	**5%**
3. Describe the demolition methods and procedures and the process to plan the removal of material. a. Sorting of waste material/equipment • Integrity of material • Hazards and safety in dismantling • Re-use/recycle b. Waste disposal regulations and specifications	**5%**
4. Describe cutting methods using manual and mechanical processes.	**10%**
5. Describe the procedures of cutting material of various thicknesses.	**10%**
6. Identify codes and regulations pertaining to sleeves and to seismic restraints.	**10%**
7. Describe the procedures used to prepare for installation of air handling systems and components. a. Determine equipment requirements b. Determine penetration locations c. Perform site measurements d. On-site co-ordination • Staging (storing material) • Planning • Distributing (material to installation area) • Sectioning (pre-assembling on site)	**10%**

- Erecting

e. Final inspection (completing)

8. Calculate orientation, alignment and projections. 10%

9. Describe installation procedures of air and material handling system components. 10%

a. Penetrations
b. Sleeves
c. Supports
d. Bases
e. Hangers
f. Cables
g. Braces
i. Brackets
j. Fire/smoke dampers

10. Interpret drawings and identify specifications for positioning of equipment, anchors, and air and material handling systems. 5%

10. Verify duct design to achieve air flow capacity. 5%

11. Identify trade standards and specifications related to the installation of air handling system components. 5%

12. Demonstrate the ability to install air handling system components. 10%

Apprenticeship Manitoba

Sheet Metal Worker

Unit: B10 Chimneys, Breeching and Venting

Level: Two

Duration: 11 hours

Theory: 7 hours

Practical: 4 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of installation procedures for chimneys, breeching and venting and to connecting appliances (including high efficiency appliances) and mechanical equipment to chimneys and breeching.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define and explain terminology associated with chimneys, breeching venting, appliances and mechanical equipment.	**10%**
2. Identify tools and equipment relating to the installation of chimneys and connecting appliances and mechanical equipment and describe their applications and procedures for use.	**10%**
3. Identify hazards and describe safe work practices and procedures pertaining to the installation of chimneys, breeching and venting and to connecting appliances and mechanical equipment to chimneys and breeching.	**10%**
4. Identify codes, standards and regulations pertaining to installing chimneys, breeching and venting and to connecting appliances and mechanical equipment to chimneys and breeching. a. Jurisdictional requirements	**10%**
5. Identify types of chimneys, breeching and venting systems and appliances and mechanical equipment and their components and describe their applications. a. Chimney classifications b. Vent classifications/combustion air	**10%**
6. Interpret information pertaining to the installation of chimneys and to connecting appliances and mechanical equipment to chimneys and breeching found on drawings, and job and manufacturers' specifications.	**10%**
7. Describe and perform calculations related to the installation and sizing. a. Combustion air b. Vent calculations c. Run/rise d. Equivalent length e. Equipment requirements	**10%**

8.	**Describe the procedures used to install chimneys and breeching and to connect them to appliances and mechanical equipment.**	**10%**
9.	**Describe the procedures used to connect chimneys, breeching and venting to the appliance.**	**10%**
10.	**Demonstrate the installation procedures for chimneys, breeching and venting and for connecting appliances and mechanical equipment to chimneys and breeching.**	**10%**