Apprenticeship Manitoba

Manitoba

Sheet Metal Worker
Level 3

Rev. October 2018

Apprenticeship Manitoba

Sheet Metal Worker

Unit: C1 Welding 3

Level: Three

Duration: 25 hours

Theory: 5 hours

Practical: 20 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of GTAW equipment, its applications and maintenance and the procedures used to weld mild steel using the GTAW process. This unit also serves as a review and continuation of *Welding 1 and 2* in Levels One and Two.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define and explain terminology associated with GTAW.	**5%**
2. Describe GTAW and its applications.	**5%**
3. Identify hazards and describe safe work practices and procedures pertaining to the use of GTAW equipment. a. Personal b. Shop/facility c. Equipment d. Ventilation	**5%**
4. Identify and describe GTAW equipment, consumables and accessories.	**5%**
5. Interpret symbols and information pertaining to the use of GTAW equipment found on drawings and specifications.	**5%**
6. Describe the procedures to set-up, adjust and shut-down GTAW equipment for welding steel.	**5%**
7. Describe the procedures used to maintain and troubleshoot GTAW equipment.	**10%**
8. Identify the types of welds performed using the GTAW Process. a. Plug b. Fillet (continuous) c. Stitch d. Tack e. Edge f. Corner	**10%**

9. Describe weld defects, their causes and the procedures to prevent and correct them. **10%**

a. Porosity
b. Cracks
c. Warping
d. Undercut

10. Describe the procedures used to weld mild steel using the GTAW process. **10%**

11. Demonstrate procedures for welding mild steel using the GTAW process. **30%**

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Unit: C2 Trade Mathematics 3

Level: Three

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 unit Trade Mathematics 2 and is intended to provide the apprentice 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 *Trade Math 1* and *2* in Levels One and Two.
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Objectives and Content:	**Percent of Unit Mark (%)**
1. Review trigonometry functions: a. Introduction to trigonometry b. Using the tangent formula c. Using the sine formula d. Using the cosine formula e. Selection of formulas	**30%**
2. Formulas and special problems for practical on-the-job applications. a. Roof slope b. Law of right angle triangles c. Stretch-out of pipes d. Boxes e. Cones f. Bend allowances g. Surface speeds (drill bits)	**30%**
3. Demonstrate the knowledge to calculate trigonometry functions, formulas and special problems as specified by the instructor.	**60%**

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Unit: C3 Science 2

Level: Three

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. This unit also serves as a review and continuation of *Science 2* in Level Two.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Review science concepts of Psychrometrics. a. Properties of air b. Temperature c. Humidity d. Enthalpy e. Volume f. Relationships between properties g. Psychrometric chart h. Using the psychrometric chart	**30%**
2. Review science concepts of basic electricity. a. Ohm's Law b. Series circuits c. Parallel circuits d. Electricity fundamentals e. Electrical devices f. Digital multimeter usage	**30%**
3. Demonstrate the knowledge of psychrometrics and basic electricity as specified by the instructor.	**40%**

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Unit: C4 Blueprint Reading/Specifications 2

Level: Three

Duration: 20 hours

Theory:	20	hours
Practical:	0	hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of blueprint reading and interpretation, specifications, the procedures used to take field measurements and the procedures used to produce material take-off lists. This unit also serves as a review and continuation of *Blueprint Reading/Specifications 1* in Level Two, with a commercial context.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe the procedures used to interpret and extract information from blueprints and specifications.	**25%**
2. Identify the purpose of submittals and shop drawings and describe the procedures used to interpret them.	**25%**
3. Describe the procedures used to take field measurements.	**10%**
4. Identify the types of material take-off lists and describe their applications and the procedures used to produce them. a. Material estimation b. Material installation	**20%**
5. Demonstrate and extract information from blueprint drawings and specifications.	**20%**

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Unit: C5 Duct System Design 2

Level: Three
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. This unit also serves as a review and continuation of *Duct System Design 1* in Level Two.

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

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Unit: C6 Pattern Development 3

Level: Three

Duration: 45 hours

Theory: 20 hours

Practical: 25 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of the procedures used to develop and fabricate complex fittings using parallel line development, radial line development and the triangulation method. This unit also serves as a review and continuation of *Pattern Development 1 and 2* in Levels One and Two.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Describe the types of complex fittings and components that require parallel line development, radial line development, and the triangulation method.	**30%**
2. Describe the procedures used to develop and fabricate complex fittings and components using parallel line development, radial line development, and the triangulation method.	**30%**
3. Demonstrate the ability to develop and fabricate complex fittings using parallel line development, radial line development, and the triangulation method.	**40%**

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Unit: C7 Fabrication 3

Level: Three

Duration: 56 hours

Theory: 0 hours

Practical: 56 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of ductwork, fittings and flexible connectors for air and material handling systems and the procedures used to assemble them. This unit also serves as a review and continuation of *Fabrication 1* and *2* in Levels One and Two.

Objectives and Content:		**Percent of Unit Mark (%)**
1.	**Identify tools and equipment used to assemble ductwork, fittings and components, and describe their applications, limitations and procedures for use.**	**5%**
2.	**Interpret information pertaining to the assembly of ductwork, fittings and components found on drawings and specifications.**	**5%**
3.	**Identify types of materials used to assemble ductwork, fittings and components and describe their characteristics and applications.**	**5%**
4.	**Identify types of welding equipment used to assemble ductwork, fittings and components.**	**5%**
5.	**Identify hazards and describe safe work practices and procedures associated with assembling ductwork, fittings, and components.**	**5%**
6.	**Identify industry standards pertaining to the assembly of ductwork, fittings, and components.**	**5%**
7.	**Describe the procedures to assemble ductwork, fittings, and components.**	**5%**
8.	**Demonstrate the ability to assemble ductwork, fittings, and components.**	**65%**

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Unit: C8 Specialty Products

Level: Three

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of specialty products and their applications, the procedures to fabricate, form, assemble and finish specialty products and of installation procedures for specialty products and their related components.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define and explain terminology associated with metallurgy and associated materials and with the fabrication of specialty products. a. Metal b. Non-metal d. Composites (i.e. awnings) e. Stainless steel f. Non-stainless steel g. Marine products	**10%**
2. Identify practices that can create problems when working with metals and describe the procedures used to prevent or correct these problems.	**10%**
3. Identify tools, equipment and products used to cut, form, assemble and surface finish specialty products and describe their applications and procedures for use.	**5%**
4. Identify types of specialty products and accessories and describe their applications. a. Kitchen b. Medical c. Food processing d. Pharmaceutical laboratory e. Decorative	**10%**
5. Identify hazards and describe safe work practices and procedures associated with cutting, forming, assembling, finishing and installing material for specialty products.	**5%**
6. Interpret and extract information pertaining to the forming, assembling, finishing, and installation of specialty products found on drawings and specifications.	**5%**

7.	**Identify industry standards and job specifications pertaining to the fabrication and installation of specialty products.**	**5%**
8.	**Calculate and measure material to be cut.**	**5%**
9.	**Identify types of materials used to form, assemble and finish specialty products and components and describe their applications.** a. Ferrous b. Non-ferrous c. Plastics/PVC d. Composites	**5%**
10.	**Describe the procedures used to fabricate specialty products and their associated components.** a. Handling b. Design c. Cut d. Form e. Assemble f. Join g. Finish	**10%**
11.	**Identify types of fasteners and fastening methods used to install specialty products and describe their applications.**	**10%**
12.	**Demonstrate the procedures used to fabricate and install specialty products.**	**20%**

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Unit: C9 Installation 3

Level: Three
Duration: 35 hours
Theory: 21 hours
Practical: 14 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of air quality and installation procedures for air handling systems. This unit also serves as a review and continuation of *Installation 1* and *2* in Levels One and Two.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with air quality management.	**5%**
2. Identify considerations and requirements associated with air quality management. a. Safety b. Codes and regulations • LEEDS • ASHRAE • SMACNA • National Building Code c. Environmental conditions	**5%**
3. Describe the importance of indoor air quality and identify areas requiring special air quality ventilation. a. Clean/sterile rooms b. Industrial/commercial settings • Factory • Public	**10%**
4. Identify the methods used to determine air quality relating to humidity and temperature.	**10%**
5. Identify air quality problems and describe the procedures used to prevent or correct them. a. Heating b. Ventilation c. Conditioning • Filtration • Sterilization • Purification	**10%**

- Humidification/dehumidification

6.	**Identify codes and trades standards pertaining to air quality management and to air handling equipment.**	**5%**
7.	**Identify tools and equipment used for installing terminal boxes, coils and plenums and describe their application and procedures for use.**	**5%**
8.	**Identify hazards and describe safe work practices and procedures pertaining to installing terminal boxes, coils and plenums, and to air quality management.**	**5%**
9.	**Interpret information pertaining to installing terminal boxes, coils, and plenums found on drawings and specifications.**	**10%**
10.	**Identify codes and trades standards pertaining to the installation of terminal boxes, coils, and plenums.** a. SMACNA b. ASHRAE c. ANSI d. NBC e. CWB f. NBC g. CWB h. NFPA i. AHJ	**10%**
11.	**Describe the procedures used to install terminal boxes, coils and plenums.**	**10%**
12.	**Demonstrate the ability to install terminal boxes, coils and plenums.**	**15%**

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Unit: C10 Testing, Adjusting and Balancing

Level: Three

Duration: 11 hours

Theory: 7 hours

Practical: 4 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of testing, adjusting and balancing procedures for air and material handling systems.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define and explain terminology associated with testing, adjusting and balancing air and material handling systems.	**5%**
2. Identify requirements and limitations relating to testing, adjusting and balancing air and material handling systems.	**5%**
3. Identify tools and testing equipment used in testing, adjusting and balancing systems and describe their applications and procedures for use. a. Electrical devices b. Air balancing devices c. Charts • Psychrometric • Fan	**5%**
4. Explain the importance of testing, adjusting and balancing to ensure optimal system performance.	**5%**
5. Identify problems pertaining to air and material handling systems and describe the procedures used to prevent and correct them. a. Lack of air pressure b. Excessive air pressure c. Incorrect installation (duct sizing, noise)	**5%**
6. Interpret information pertaining to testing, adjusting and balancing found on drawings and specifications.	**5%**
7. Identify types of tests relating to air and material handling system components and describe the procedures used to perform them. a. Pressure/smoke test b. Air flow c. Velocity/volume	**5%**

8. Identify hazards and describe safe work practices and procedures associated with testing, adjusting and balancing. 5%

9. Identify trade standards pertaining to testing, adjusting and balancing on air and material handling systems. 5%

10. Describe the procedures and techniques used to perform balancing on air handling systems. 5%

11. Describe the procedures to adjust air handling system equipment and components to optimize performance. 25%

a. Motor pulleys
b. Dampers
c. Blower pulleys
d. Three-stage fans
e. Variable speed drives
f. Test port

12. Demonstrate the ability to perform testing, adjusting and balancing procedures for air and material handling systems. 25%

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Unit: C11 Maintenance and Repair (Air and Material Handling Systems)

Level: Three

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of maintenance and repair procedures for material handling systems and testing devices and their applications.

Objectives and Content:	**Percent of Unit Mark (%)**
1. Define terminology associated with inspecting, diagnosing and servicing system components and with the repair of faulty components.	**5%**
2. Identify tools and equipment used to inspect, diagnose and service system components and the repair of worn or faulty components and describe their applications, limitations, and procedures for use.	**5%**
3. Identify types of tests, testing devices and readings required to inspect, diagnose and service system components and describe their procedures for use. a. Thermal imaging devices b. Multimeters c. Tachometers d. Belt-tensioning tools e. Thermometers f. Stethoscope g. Refrigeration gauges h. Leak detectors i. Manometer	**10%**
4. Identify hazards and describe safe work practices and procedures pertaining to the inspecting, diagnosing and servicing of system components and to the repair of worn or faulty components.	**10%**
5. Identify codes, regulations and trade standards pertaining to the inspecting, diagnosing and servicing of system components and to the repair of worn or faulty components.	**10%**
6. Identify considerations for inspecting, diagnosing and servicing system faults in system components and for the repair of worn or faulty components. a. Sounds b. Vibration	**10%**

c. Odors
d. Heat build-up
e. Visual

7. Describe the procedures used to perform calculations to determine system performance and to diagnose and service system faults in system components. **10%**

8. Identify electrical devices and describe their purpose. **10%**

a. Circuit breakers
b. Disconnects
c. Overload heaters
d. GFI
e. Fuses
f. PLC
g. Motors
h. Variable speed drives (VSD)
i. Flow switches
j. Thermostats

9. Describe the procedures used to diagnose system faults and service system components and to repair worn or faulty components. **15%**

a. Scheduled
   - Filters
   - Lubrication
   - Adjustments
b. Emergency
c. Lock out

10. Demonstrate the maintenance and repair procedures for air and material handling systems and testing devices and their applications. **15%**