

Sheet Metal Worker Level 4

Sheet Metal Worker

Unit: D1 Welding 4

Level: Four

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 steel, aluminum and stainless steel using the GMAW and GTAW processes. This unit also serves as a review and continuation of *Welding 1, 2, 3* in Levels One, Two and Three.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with GMAW and GTAW.	5%
2. Describe the GMAW and GTAW processes and their applications.	5%
3. Identify and describe types of GMAW and GTAW equipment, consumables and accessories used to weld steel, aluminum and stainless steel and describe their characteristics and applications.	10%
4. Describe the procedures to set-up, adjust and shut-down GMAW and GTAW equipment.	10%
5. Identify the types of welds performed using the GMAW and GTAW processes. a. Plug b. Fillet (continuous) c. Stitch d. Tack e. Edge f. Corner	10%
6. Describe the procedures used to maintain and troubleshoot GMAW and GTAW equipment.	5%
7. Interpret symbols and information pertaining to GMAW and GTAW welding found on drawings and specifications.	5%
8. Identify hazards and describe safe work practices and procedures pertaining to the use of GMAW and GTAW equipment.	5%

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| 9. Describe weld defects, their causes and the procedures to prevent and correct them. | 10% |
| 10. Describe the procedure to weld steel, aluminum and stainless steel using GMAW and GTAW processes. | 10% |
| 11. Demonstrate the ability to weld steel, aluminum and stainless steel using GMAW and GTAW processes. | 25% |

Sheet Metal Worker

Unit: D2 Trade Mathematics 4

Level: Four

Duration: 22 hours

Theory: 22 hours

Practical: 0 hours

Overview:

This unit builds on the general mathematical concepts of the course Trade Mathematics 3.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Review of Trade Mathematics 1, 2, and 3 units.	50
2. Demonstrate the knowledge of general mathematical concepts as specified by the instructor.	50

Sheet Metal Worker

Unit: D3 Science 3

Level: Four

Duration: 14 hours

Theory: 14 hours

Practical: 0 hours

Overview:

This unit builds on the concepts from Science 1 and 2.

Objectives and Content:

**Percent of
Unit Mark (%)**

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| 1. Review of Science 1 and 2. | 50% |
| 2. Demonstrate the knowledge of science concepts as specified by the instructor. | 50% |

Sheet Metal Worker

Unit: D4 Blueprint Reading/Specifications 3

Level: Four

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate advanced knowledge of blueprint and specifications reading and interpretation, 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 1,2, 3* in Levels One, Two and Three, with a commercial context.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe the procedures used to interpret and extract information from advanced blueprints and specifications.	10%
2. Identify the purpose of submittals and shop drawings and describe the procedures used to interpret them.	10%
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 advanced blueprint drawings and specifications.	50%

Sheet Metal Worker

Unit: D5 Pattern Development 4

Level: Four

Duration: 46 hours

Theory: 21 hours

Practical: 25 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of the procedures used to develop pattern in a three-dimensional view using computer technology. This unit also serves as a review and continuation of *Pattern Development 1,2, 3* in Levels One, Two and Three.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with pattern development and layout.	20%
2. Describe the procedures used to perform pattern development using computer technology.	20%
3. Identify layout tools and describe their applications and procedures for use.	20%
4. Identify layout methods and describe their applications.	20%
5. Demonstrate the ability to develop pattern using computer technology.	20%

Sheet Metal Worker

Unit: D6 Fabrication 4

Level: Four

Duration: 49 hours

Theory: 0 hours

Practical: 49 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of sheet metal components for material handling systems and the procedures used to fabricate them. This unit also serves as a review and continuation of *Fabrication 1, 2, 3* in Levels One, Two and Three.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define and explain terminology associated with material handling systems.	5%
2. Identify tools and equipment used to fabricate sheet metal components for material handling systems, and describe their applications, limitations and procedures for use.	5%
3. Identify types of materials used in fabricating sheet metal components for material handling systems and describe their characteristics and applications.	15%
4. Identify and describe sheet metal components associated with material handling systems.	15%
a. Ductwork	
b. Fittings	
c. Dampers	
d. Fire dampers	
e. Flexible connections	
f. Hangers	
g. Equipment supports/bases	
h. Louvers	
i. Attenuators (silencer)	
5. Identify considerations and requirements when fabricating sheet metal components for material handling systems.	15%
a. Load bearing capacities	
b. System specifications	
c. Codes and regulations	
• SMACNA	
• ASHRAE	
• NBC	

- d. Environmental conditions
 - e. Architectural conditions
- 6. Describe the procedures used to fabricate sheet metal components for material handling systems. 15%**
- a. Cut
 - b. Label
 - c. Form
 - d. Insulate
 - e. Assemble
- 7. Identify the types of basic surface finishes and describe their applications. 15%**
- 8. Demonstrate the procedures used to fabricate sheet metal components for material handling systems. 15%**

Sheet Metal Worker

Unit: D7 Installation 4

Level: Four

Duration: 42 hours

Theory: 21 hours

Practical: 21 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of installation procedures for pneumatic and gravity and mechanized material handling system components. This unit also serves as a review and continuation of *Installation 1,2, 3* in Levels One, Two and Three.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify the types of pneumatic and gravity and mechanized material handling systems and describe their applications, principles and operation.	10%
a. Conveyors	
b. Chutes	
c. Blow pipe/dust collection	
2. Identify pneumatic and gravity and mechanized material handling system components and describe their applications.	10%
a. System components	
• Fans	
• Collection devices	
• Cyclone	
b. Sheet metal components	
• Ductwork	
• Fittings	
• Dampers	
• Hangers	
• Braces	
• Brackets	
c. Accessories	
• Access doors	
• Blast gates	

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| 3. | Interpret information pertaining to the installation of pneumatic and gravity and mechanized material handling system components found on drawings and job specifications. | 10% |
| 4. | Identify hazards and describe safe work practices and procedures pertaining to the installation of pneumatic and gravity and mechanized material handling system components. | 10% |
| 5. | Identify trade standards pertaining to pneumatic and gravity and mechanized material handling system components. | 10% |
| 6. | Describe the procedures used to prepare for installation of pneumatic and gravity and mechanized material handling system components. | 10% |
| | <ul style="list-style-type: none"> a. Determine equipment requirements b. Verify duct sizing c. Determine penetration locations d. Perform site measurements e. On-site co-ordination <ul style="list-style-type: none"> • Staging (storing materials) • Planning • Distributing (material to installation area) • Sectioning (pre-assembling on site) • Erecting f. Final inspection (completing) | |
| 7. | Identify considerations for installing pneumatic and gravity and mechanized material handling system components. | 10% |
| | <ul style="list-style-type: none"> a. Codes and regulations b. Manufacturers' specifications c. Isolators d. Building materials e. Environmental conditions <ul style="list-style-type: none"> • Weather and seismic conditions | |
| 8. | Describe the procedures used to install pneumatic and gravity and mechanized material handling system components. | 10% |
| 9. | Demonstrate the ability to install pneumatic and gravity and mechanized material handling system components. | 20% |

Sheet Metal Worker

Unit: D8 Thermal Insulation, Lagging, Cladding and Flashing

Level: Four

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge to apply thermal insulation, lagging, cladding and flashing.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify types and properties of thermal insulation, lagging, cladding and flashing used to apply components.	10%
2. Identify tools and equipment used to apply thermal insulation, lagging, cladding and flashing to components, and describe their applications, limitations and procedures for use.	10%
3. Interpret information pertaining to the application of insulation, lagging, cladding and flashing to components found on drawings and specifications.	10%
4. Identify hazards and describe safe work practices and procedures associated with applying thermal insulation to components.	15%
5. Identify trade standards pertaining to insulating components.	10%
6. Identify the methods used to secure and seal material, seams and joints and to apply flashing.	15%
7. Calculate measurements of materials and seam and joint allowances before cutting, and of flashing before installing.	15%
8. Identify considerations when installing flashing to components.	15%
a. Isolators	
b. Building materials	
c. Environmental conditions	
d. Field design modifications	

Sheet Metal Worker

Unit: D9 Leak Testing, Air Balancing and Commissioning

Level: Four

Duration: 13 hours

Theory: 7 hours

Practical: 6 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge to commission air and material handling systems and components.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define and explain terminology associated with commissioning.	20%
2. Explain the purpose of commissioning and identify the types of air and material handling systems and components.	20%
3. Interpret documentation pertaining to commissioning. a. Equipment shop drawings b. As-built drawings c. Test results	20%
4. Describe the procedures used to commission air and material handling systems and components.	20%
5. Demonstrate the ability to commission air and material handling systems and components.	20%

Sheet Metal Worker

Unit: D10 Journeyperson Trainer

Level: Four

Duration: 7 hours

Theory: 7 hours

Practical: 0 Hours

Overview:

Level One in-school Technical Training offers an entry-level orientation to the challenges of apprenticeship training as it relates to the development of core tasks and skill requirements as well as social competencies. This unit introduces senior apprentices to the responsibilities of workplace *training* that they will assume as supervising journeypersons. Most trades have a rich tradition of refreshing and sharing their skills from one generation of trade practitioners to the next. This unit orients senior apprentices to some of the practical and conceptual tools that can enable them to contribute to this trade heritage when they become certified journeypersons and, ultimately, journeyperson trainers.

The journeyperson's obligation to assist entry-level apprentices to develop skills and knowledge is complex and challenging. It involves safety considerations, employer expectations, provincial regulations, as well as the tradition of skills stewardship that links modern practice with the long history of workplace teaching and learning that defines the apprenticeship trades. The ability to offer timely and appropriate support to apprentices is itself an important area of trade learning. This unit presents material intended to help refine this ability through reflection and discussion by senior apprentices, and discussion with their in-school instructor and journeyperson trainer.

This content reflects Manitoba and Canadian standards prescribed for journeyperson-level supervisory capabilities, as well as key topics in current research on the importance of workplace training in apprenticeship systems. The unit objectives represent suggested focal points or guidelines for potentially-worthy exploration and are neither mandatory nor exhaustive.

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

Objectives and Content:	Percent of Unit Mark (%)
<p>1. Compare/contrast role-options and responsibilities of the supervising journeyperson.</p> <p>a. Implicit vs. explicit standards and content: training goals are/are not codified; assessment measures are/are not used.</p> <p>b. Accountability for results: e.g., journeyperson is/is not required to prepare performance evaluation that could affect apprentice's employability or wage-rate, etc.</p> <p>c. Long-term vs. short-term supervision assignments – e.g., considerable latitude/little latitude for apprentice to learn from mistakes</p> <p>d. Formally vs. informally structured: e.g. supervision assignment is part of a prescribed cycle of assignments involving coordination among multiple journeypersons; apprentice is trained according to an individual Training Plan negotiated with employer</p>	n/a

- e. Types of supervisory role options and what is implied by each:
 - Journeyman Trainer (JT) role: is often initiated by someone other than apprentice, and limited to a particular skill set, task, or production requirement
 - Mentor role : often initiated by apprentice and relatively open-ended regarding content, duration, etc.
 - Peer role: typically involves individual upgrading or cross-training of one journeyman by another; can include senior apprentice assisting less-experienced trade learner
 - Coordinator role: often a senior-level journeyman appointed by an organization to assume responsibilities for monitoring progression of groups of apprentices
 - Other roles: may be improvised by journeyman such as combination or multiple roles of the above

2. Describe and demonstrate common requirements about providing journeyman supervision. n/a

- a. Apprenticeship learning adapted to journeyman supervision assignments and a journeyman perspective
 - Application of adult education concepts to trades teaching and learning (e.g. responsibilities and expectations of senior-level apprentices)
 - Practical significance of 'styles' of adult learning and teaching
 - Helping senior-level apprentices to integrate in-school technical training and on-the-job practical training experiences
 - Providing help and guidance about new tasks and skills
 - Providing help and guidance about fixing mistakes
 - Learning and teaching "the ropes" – socialization of apprentice within a community of trade practice (e.g. how to borrow a tool, interrupt a journeyman, seek advice of experienced co-workers)
 - Coverage and documentation of prescribed tasks and subtasks where applicable
 - Discuss the limits of the journeyman trainer's own responsibilities and competence (e.g. scope, willingness to train, etc.)
 - Benefits of maintaining a personal record of achievements, ideas, and needs as a journeyman trainer (e.g. resume, portfolio, training credentials, logbook, etc.)
- b. Individual reflection and guided group discussion about personal experiences of workplace learning as an apprentice
 - Identification of best and worst practices of journeyman trainer
 - Identification of workplace and other factors that can contribute to good and bad trades teaching and learning experiences
 - Development of professional standards and work ethics about responsibility to share one's knowledge and skill with others in the workplace (e.g., use/misuse of humour, rigour, discretion, craft-pride, etc.)
 - Qualities of a good journeyman trainer
 - Components of workplace journeyman training
 - Processes and recommended practices in journeyman training
 - Troubleshooting problems in supervision assignments
- c. Role of assessment in supervising, coaching, or guiding other people to learn or improve their skills (e.g. formative and summative evaluation), and how this might contribute to how the journeyman supervision task is approached in future
- d. Compare and contrast discussion results with current knowledge and resources about workplace training methods as they apply to journeyman supervision assignments

Sheet Metal Worker

Unit: D11 Pre-IP Examination Review

Level: Four

Duration: 35 hours

Theory: 35 hours

Practical: 0 hours

Overview:

This unit offers senior apprentices a systematic review of skills and knowledge required to pass the Interprovincial (IP) Examination. It promotes a purposeful personal synthesis between on-the-job learning and the content of in-school technical training. The unit includes information about the significance of IP certification and the features of the IP Examination. No testing is prescribed for the theory section of this instruction unit. Instead, a “pass/fail” grade will be awarded upon completion of the unit.

Objectives and Content:

**Percent of
Unit Mark (%)**

1. **Describe the significance, format and general content of Interprovincial Examinations for the trade of Sheet Metal Worker.**
 - a. Scope and aims of Interprovincial (IP) certification; value of certifications
 - b. Obligations of candidates for IP certification
 - Relevance of IP Examinations to current, accepted trade practices; industry-based validation of test items
 - Supplemental policy (retesting)
 - Confidentiality of examination content
 - c. Multiple-choice format (four-option) item format, Red Seal standards for acceptable test items
 - d. Government materials relevant to the IP Examinations for apprentice Sheet Metal Workers
 - Red Seal Occupational Standard (RSOS); prescribed scope of the skills and knowledge which comprise the trade
 - RSOS “pie-chart” and its relationship to content distribution of IP Examination items
 - Apprenticeship Manitoba Technical Training package

2. **Identify resources, strategies and other considerations for maximizing successful completion of written examinations.**
 - a. Personal preparedness
 - Rest
 - Nutrition
 - Personal study regimen
 - Prior experience in test situations (e.g., unit tests)

- b. Self-assessment, consultation and personal study plan
 - Self-assessment of individual strengths/weaknesses in trade related skills and knowledge
 - Approved textbooks
 - Study groups
- 3. **Review program content regarding occupational skills.**
- 4. **Review program content regarding sheet metal fabrication.**
- 5. **Review program content regarding air and material handling system installation.**
- 6. **Review program content regarding roofing and specialty product installation.**
- 7. **Review program content regarding maintenance and repair.**