

Sheet Metal Worker Level 4

Sheet Metal Worker

Unit: A16 Advanced Blueprint Reading/Specifications

Level: Four

Duration: 35 hours

Theory: 17 hours

Practical: 18 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.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe the procedures used to interpret and extract information from advanced blueprints and specifications.	20%
2. Identify the purpose of submittals and shop drawings and describe the procedures used to interpret them.	20%
3. Describe the procedures used to take field measurements.	5%
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	5%
5. Demonstrate and extract information from advanced blueprint drawings and specifications.	50%

Sheet Metal Worker

Unit: A20 Shielded Metal Arc Welding (SMAW)

Level: Four

Duration: 20 hours

Theory: 8 hours

Practical: 12 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of SMAW equipment, its applications, maintenance and procedures for use, and of weld defects, their causes and the procedures used to prevent and correct them.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define and explain terminology associated with SMAW.	5%
2. Describe SMAW and its applications.	5%
3. Identify safety precautions when using SMAW equipment. a. Personal b. Shop/facility c. Equipment d. Ventilation	5%
4. Identify and describe SMAW equipment and accessories.	5%
5. Describe the procedures to set-up, adjust and shut-down SMAW equipment.	5%
6. Describe the procedures used to maintain and troubleshoot SMAW equipment.	5%
7. Identify the types of welds performed using SMAW equipment. a. Plug b. Fillet (continuous) c. Stitch d. Tack e. Edge f. corner	5%
8. Describe the procedures used to weld various materials using the SMAW process.	5%
9. Demonstrate SMAW welding.	60%

Sheet Metal Worker

Unit: A21 Oxy-fuel Cutting, Heating and Brazing

Level: Four

Duration: 15 hours

Theory: 6 hours

Practical: 9 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of oxy-fuel cutting and heating equipment, its maintenance and procedures for use, and of brazing equipment, its maintenance and procedures for use.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify oxy-fuel cutting, heating and brazing equipment and accessories and describe their applications.	5%
2. Identify safety considerations when using oxy-fuel cutting, heating and brazing equipment. <ul style="list-style-type: none"> a. Personal b. Shop/facility c. Equipment d. Ventilation 	5%
3. Describe the procedures used to set-up, adjust and shutdown oxy-fuel cutting and heating equipment.	5%
4. Describe the procedures used to maintain and troubleshoot oxy-fuel cutting and heating equipment.	5%
5. Describe the procedures to set-up, adjust and shut-down brazing equipment.	5%
6. Describe the procedures used to maintain and troubleshoot brazing equipment.	5%
7. Describe the procedures used to cut using oxy-fuel equipment.	5%
8. Identify types of materials used for brazing.	5%
9. Describe the procedures used to braze various materials.	5%
10. Demonstrate oxy-fuel cutting, heating and brazing.	55%

Sheet Metal Worker

Unit: B4 Trade Mathematics IV

Level: Four

Duration: 24 hours

Theory: 24 hours

Practical: 0 hours

Overview:

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

Objectives and Content:

**Percent of
Unit Mark (%)**

- | | |
|---|-----|
| 1. Review of Trade Mathematics I, II, and III units. | 60% |
| 2. Formulas and special problems for practical on-the-job applications. | 40% |
| 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) | |

Sheet Metal Worker

Unit: B7 Science III

Level: Four

Duration: 24 hours

Theory: 24 hours

Practical: 0 hours

Overview:

This unit builds on the concepts from Science I and II.

Objectives and Content:

**Percent of
Unit Mark (%)**

1. Review of Science I and II.

100%

Sheet Metal Worker

Unit: C6 Fabrication (Material Handling Systems and Components)

Level: Four

Duration: 35 hours

Theory: 21 hours

Practical: 14 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.

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.	5%
3. Identify types of materials used in fabricating sheet metal components for material handling systems and describe their characteristics and applications.	10%
4. Identify and describe sheet metal components associated with material handling systems.	25%
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 requirements.	5%
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. | 5% |
| a. Cut | |
| b. Label | |
| c. Form | |
| d. Insulate | |
| e. Assemble | |
| 7. Identify the types of basic surface finishes and describe their applications. | 5% |
| 8. Demonstrate procedures for fabricating sheet metal components. | 40% |

Sheet Metal Worker

Unit: D2 Installation (Material Handling Systems)

Level: Four

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of installation procedures for material handling systems and their components.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify the types of material handling systems and describe their applications, principles and operation.	20%
a. Conveyors	
b. Chutes	
c. Blow pipe/dust collection	
2. Identify material handling system components and describe their applications.	20%
a. System components	
• Fans	
• Collection devices	
• Cyclone	
b. Sheet metal components	
• Ductwork	
• Fittings	
• Hangers	
• Braces	
• Brackets	
c. Accessories	
• Access doors	
• Blast gates	
3. Describe the procedures used to prepare for installation of material handling system components.	20%
a. Determine equipment requirements	
b. Verify duct sizing	
c. Determine penetration locations	
d. Perform site measurements	
e. On-site co-ordination	
• Staging (storing materials)	
• Planning	

- Distributing (material to installation area)
 - Sectioning (pre-assembling on site)
 - Erecting
 - f. Final inspection (completing)
- 4. Identify considerations for installing material handling system components. 20%**
- a. Codes and regulations
 - b. Manufacturers' specifications
 - c. Isolators
 - d. Building materials
 - e. Environmental conditions
 - Weather and seismic conditions
- 5. Describe the procedures used to install material handling system components. 20%**

Sheet Metal Worker

Unit: E1 Metal Roofing and Architectural Metal

Level: Four

Duration: 7 hours

Theory: 7 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, cladding and architectural metals.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define and explain terminology associated with metal roofing, cladding and architectural metals.	5%
2. Identify tools and equipment used to fabricate and install metal roofing, cladding and architectural metals and describe their applications and procedures for use.	5%
3. Identify types of materials used in fabricating metal roofing, cladding and architectural metals.	5%
4. Identify types of components associated with metal roofing, cladding and architectural metals and describe their applications.	15%
a. Roof drainage	
b. Flashing	
c. Soffit and fascia	
d. Roof vents	
5. Describe the procedures used to fabricate metal roofing, cladding and architectural metals and their associated components.	15%
a. Layout	
b. Determine seam	
c. Cut	
d. Form	
6. Identify considerations and requirements relating to installing metal roofing, cladding and architectural metals.	5%
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, cladding 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 cladding and architectural metals.** 10%
 - 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, cladding 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, cladding and architectural metals.** 5%
12. **Describe the procedures used to install metal roofing, cladding and architectural metals.** 5%
 - a. Cut
 - b. Fit
 - c. Secure
 - d. Seal
13. **Identify types of metal decking and describe their applications.** 5%
 - a. Metal pan
 - b. Q decking
14. **Describe the procedures used to install decking.** 5%
15. **Identify types of exterior components and describe their applications.** 5%
 - a. Awnings
 - b. signage

Sheet Metal Worker

Unit: E2 Specialty Products

Level: Four

Duration: 28 hours

Theory: 22 hours

Practical: 6 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of specialty products and their applications, of fabrication procedures for specialty products and of installation procedures for specialty products and their related components.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define and explain terminology associated with the fabrication of specialty products. a. Metal b. Non-metal	10%
2. Identify types of specialty products and accessories and describe their applications. a. Kitchen b. Medical c. Food processing d. Pharmaceutical laboratory e. Decorative	10%
3. Identify types of materials used in fabricating specialty products and components and describe their applications. a. Ferrous b. Non-ferrous c. Plastics/PVC d. Composites (i.e. awnings)	10%
4. Identify tools and equipment used to fabricate and install specialty products and describe their applications and procedures for use.	10%
5. Describe the procedures used to fabricate specialty products and their associated components. a. Handling b. Design c. Cut d. Form e. Assemble	10%

- f. Join
 - g. Finish
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- 6. Identify considerations and requirements for installing specialty products. 10%**
 - a. Codes and regulations
 - b. Manufacturers' specifications
 - c. Environmental conditions
 - Weather and seismic conditions
 - d. Sanitation

 - 7. Identify types of fasteners and fastening methods used to install specialty products and describe their applications. 10%**

 - 8. Describe the procedures used to install specialty products. 10%**

 - 9. Demonstrate PVC welding. 20%**

Sheet Metal Worker

Unit: F1 Maintenance and Repair (Air and Material Handling Systems)

Level: Four

Duration: 28 hours

Theory: 14 hours

Practical: 14 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:	<u>Percent of Unit Mark (%)</u>
1. Identify considerations and equipment used in maintenance and repair of air and material handling systems components and describe their applications. a. Testing devices	10%
2. Identify considerations for maintenance inspection of air and material handling system components. a. Sounds b. Vibration c. Odors d. Heat build-up e. Visual	10%
3. Describe the procedures used to troubleshoot air and material handling system components.	10%
4. Describe the procedures used to service air and material handling system components. a. Scheduled • Filters • Lubrication • Adjustments b. Emergency c. Lock out	10%
5. Describe the procedures used to repair or replace worn, faulty or defective components of air or material handling systems.	10%
6. Demonstrate maintenance and repair procedures for material handling systems and testing devices and their applications.	50%

Sheet Metal Worker

Unit: F2 Testing, Adjusting and Balancing (Air and Material Handling Systems)

Level: Four

Duration: 21 hours

Theory: 15 hours

Practical: 7 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:	<u>Percent of Unit Mark (%)</u>
1. Define and explain terminology associated with testing, adjusting and balancing air and material handling systems.	10%
2. Identify requirements and limitations relating to testing, adjusting and balancing air and material handling systems.	10%
3. Identify tools and instruments used in testing, adjusting and balancing systems and describe their applications and procedures for use. <ul style="list-style-type: none"> a. Electrical devices b. Air balancing devices c. Charts <ul style="list-style-type: none"> • Psychrometric • Fan 	10%
4. Describe the importance of testing, balancing and adjusting to ensure optimal system performance.	10%
5. Identify types of tests relating to air and material handling system components and describe the procedures used to perform them. <ul style="list-style-type: none"> a. Leak/pressure test 	10%
6. Describe the procedures and techniques to perform air balancing on air handling systems.	10%
7. Describe the procedures to adjust air handling system components to optimize performance.	10%
8. Demonstrate testing, adjusting and balancing procedures for air and material handling systems.	30%

Sheet Metal Worker

Unit: A2 Orientation II: The Job of Journeywork

Level: Four

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Sheet Metal Worker technical training offers an entry-level orientation to the challenges of apprenticeship learning. The present unit introduces senior apprentices to the responsibilities of workplace *teaching* that they will assume as supervising journeypersons. Tradeworkers have a particularly rich tradition of refreshing and sharing their skills from one generation of 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 themselves become certified journeypersons. The journeyperson's obligation to assist trade learners 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 apprenticeable trades. The ability to offer timely, 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 dialogue with their instructor. The detailed descriptors under each unit objective reflect Manitoban and Canadian standards prescribed for journey-level supervisory capabilities, as well as key topics in current research on the importance of workplace teaching and learning in trades-apprenticeship systems. Thus, descriptors represent suggested focal points or guidelines for potentially-worthwhile exploration. Delivery of this content will vary with the discretion of individual instructors, and with the experiences senior apprentices bring forward for group/individual reflection on the skills-stewardship dimension of their own future practice as journeypersons.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe the scope, substance, and significance of journey-level status.	20%
a. Historical background, including trainee experiences <ul style="list-style-type: none">• Origin, definition, and examples of journey-level status• Obligations to employers, trade clients, and apprentices• Concept of skills stewardship, and its rationale• Customary responsibilities of journeyperson as workplace trainer/supervisor• Overview development of formal systems for regulating/recognizing journey-level competence in designated apprenticeable trades• Contributions of 'unticketed journeymen' and other informally-qualified Ironworkers to workplace trade-learning• Achievements/limitations of informal systems for workplace training• Trends (e.g. succession planning in the trades; recognition of credentials and prior learning; defined standards for on-the-job trades education and training)	
b. Regulatory/legal dimensions of journey-level status in designated trades <ul style="list-style-type: none">• Rights and obligations re: Canada's Interprovincial 'Red Seal' program (Red Seal rationale, scope, and products, including the National Occupational Analysis	

- [NOA], and Interprovincial examinations)
 - Manitoba provincial requirements [e.g. *Apprenticeship and Trades Qualifications Act; General Regulation; the Sheet Metal Worker Trade Regulation*; relevant policies of the Apprenticeship and Trades Qualifications Board of Manitoba]
 - Trade-specific requirements re: practical training supervision and documentation; importance of quality assurance and broad-scope coverage of prescribed task-content; ratios, etc.
- c. Other (as may be specified by instructor)

2. Compare/contrast role-options and responsibilities of the supervising journeyperson. 20%

- a. Recognizing the variability of supervision assignments, situations, and roles
- b. Source and specification of the supervision assignment
- c. Formal vs. informal roles (e.g. mandated by an employer's succession plan)
- d. Implicit vs. explicit standards and content: training goals are/are not codified; assessment measures are/are not used
- e. Accountability for results: subject/not subject to third-party notification; completion of supervision assignment itself is/is not assessed by third party; journeyperson is/is not required to prepare performance evaluation that could affect apprentice's employability or wage-rate, etc.
- f. General vs. task- or job-specific supervision assignments: e.g. scope of expectations re: content of supervisory task(s)
- g. Long-term vs. short-run supervision assignments – e.g., considerable latitude/little latitude for apprentice to learn from mistakes
- h. 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
- i. Typology of common supervisory role-options and what is implied by each:
 - Coach 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 journeyperson by another; can include senior apprentice assisting less-experienced trade learner
 - Managerial role(s): can shade over into hire/fire issues as lead-hand or site-boss
 - Coordinator role: often a senior-level journeyperson appointed by an organization to assume responsibilities for monitoring progression of groups of apprentices
 - Other roles: may be improvised by journeyperson
- j. Possibilities, perils, and likelihood of role-overlap in 'real-life' trade practice
- k. Importance of clarifying all roles, expectations, and implications involved in accepting a supervision assignment
- l. Role of Apprenticeship Training Coordinator (ATC), Manitoba Apprenticeship Branch
- m. Resources for developing skills and knowledge re: providing journey-level supervision
 - Books and journals (not always trade-specific)
 - Websites
 - Conversation with trade instructors, journeypersons, and peers
 - Workshops
- n. Other (as may be specified by instructor)

3. Describe/demonstrate common requirements re: providing journey-level supervision. 20%

- a. Review Unit A1 content re: challenges/opportunities opportunities of apprenticeship learning adapted to journey-level supervision assignments and a journey-level standpoint
 - Application of adult education concepts to trades teaching/learning (e.g. responsibilities and expectations of adult learners)

- Practical significance of ‘styles’ of adult learning and teaching
 - Helping apprentices to integrate technical training (in school) and practical training (on-the-job) learning experiences
 - Providing help and guidance re: new tasks and skills
 - Providing help and guidance re: fixing mistakes
 - Learning/teaching “the ropes” – socialization of learner within a community of trade practice (e.g. how to borrow a tool, interrupt a journeyperson, ‘recruit’ an advisor)
 - Coverage/documentation of prescribed tasks and subtasks (Landscape Horticulturist NOA), including responsibility re: logbook sign-off (where applicable)
 - Consultation with Apprenticeship Training Coordinator (ATC), Manitoba Apprenticeship Branch
 - Communicating with apprentices and employers about supervision assignments and assignment specifications, including the limits of the trainers’ own responsibilities and competence (e.g. substance-abuse intervention)
 - Benefits of maintaining a personal record of achievements, ideas, and needs as a workplace trainer
- b. Individual reflection and guided group discussion re: personal experiences of workplace learning as an apprentice
- Identification of best and worst practices of supervising journeypersons
 - Assessment of personal experiences (if any) to date in supervising, coaching, or guiding other people to learn or improve their skills (e.g. entry-level apprentices, members of athletic team, younger family members, etc.), and how this might compare/contrast with the journey-level support of apprenticeship learning
 - Identification of workplace and other factors that can contribute to good and bad trades teaching/learning experiences
 - Development of personal standards re: responsibility to share one’s knowledge and skill with others in the workplace (e.g., use/misuse of humour, rigour, discretion, craft-pride, etc.)
- c. Comparison/contrast of discussion results with current knowledge/resources re: workplace skills coaching methods as applicable to journey-level supervision assignments
- Qualities of a good workplace coach
 - Components of workplace skills coaching
 - Processes and recommended practices re: workplace coaching
 - Troubleshooting problems re: supervision assignments
- d. Other (as may be specified by instructor)

4. Complete Modules 1 to 3, *Workplace Coaching Skills* (or equivalent). 20%

- a. Identifying purpose of the lesson
- Explaining the point of the lesson
 - Role of the coach in specific coaching situation
 - Other (specified by instructor)
- b. Linking the lesson
- Learner needs
 - Lesson sequence
 - Focus on learner
 - Selection/timing of coaching opportunities
- c. Demonstration of skill/task to be learned
- Starting the coaching session
 - Demonstration
 - Hands-on trial
 - Recap for learner

5. Complete Modules 4 to 6, *Workplace Coaching Skills* (or equivalent). 20%

- a. Practice of skill/task to be learned
- Nature and importance of practice

- Setting up for learner practice
- Types of practice
- Recycling and reinforcing skill/task learning
- b. Providing feedback to the learner
 - Value of feedback
 - Kinds of feedback
 - Guidelines and tips
- c. Assessment
 - Value of assessing learner progress
 - Assessing level of skill
 - Planning further steps toward skill/task mastery

Sheet Metal Worker

Unit: A22 Pre-Interprovincial Review

Level: Four

Duration: 28 hours

Theory: 28 hours

Practical: 0 hours

Overview:

This unit offers senior apprentices a systematic review of skills and knowledge required to pass the Provincial 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 Provincial certification and the features of the Provincial 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 Provincial Examinations for the trade of Sheet Metal Worker.**
 - a. Scope and aims of Provincial certification; value of certifications
 - b. Obligations of candidates for Provincial certification
 - Relevance of Provincial Examinations to current, accepted trade practices; industry-based provincial validation of test items
 - Supplemental policy (retesting)
 - Confidentiality of examination content
 - c. Multiple-choice format (four-option) item format, Apprenticeship Manitoba standards for acceptable test items
 - d. Government materials relevant to the Provincial Examinations for apprentice Sheet Metal Workers
 - National Occupational Analysis (NOA); prescribed scope of the skills and knowledge with comprise the trade
 - NOA “pie-chart” and its relationship to content distribution of Provincial 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, architectural metal and specialty product installation.**
 7. **Review program content regarding maintenance and repair.**
