

Steamfitter-Pipefitter Level 4

Steamfitter-Pipefitter

UNIT D1 COMPLEX RIGGING

Subunit: D1a Fundamentals of Complex Rigging

Level: Four

Duration: 14 hours

 Theory: 7 hours

 Practical: 7 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the fundamentals of complex rigging.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Prepares lift plan for complex and critical rigging, hoisting, lifting and positioning.	20%
2. Performs calculations for complex and critical rigging, hoisting, lifting and positioning.	20%
3. Selects rigging, hoisting, lifting and positioning equipment for complex and critical lifts.	20%
4. Sets up rigging, hoisting, lifting and positioning equipment for complex and critical lifts.	20%
5. Performs complex and critical lifts and positioning.	20%

Steamfitter-Pipefitter

UNIT D2 PROCESS PIPING

Subunit: D2a Process Piping Systems

Level: Four

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of process piping systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with process piping systems.	10%
2. Identify hazards and describe safe work practices pertaining to process piping systems.	10%
3. Interpret codes and regulations pertaining to process piping systems.	10%
4. Interpret information pertaining to process piping systems found on drawings and specifications.	10%
5. Identify tools and equipment relating to process piping systems and describe their applications and procedures for use.	10%
6. Identify types of process piping systems and describe their characteristics and applications. a. Gas/oil refining b. Pulp production c. Mining d. Food processing e. Chemical production	10%
7. Identify process piping system components and describe their purpose and operation.	10%
8. Describe the procedures used to install process piping systems and their components.	10%
9. Describe the procedures used to maintain and repair process piping systems and their components.	10%

10. Describe the procedures used to test and troubleshoot process piping systems and their components. 10%

Steamfitter-Pipefitter

Subunit: D2b System Testing and Commissioning I

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning for process piping systems.

Objectives and Content:	Percent of Unit Mark (%)
1. Describe how to flush and chemically treat system, pre-check system and select and connect commissioning and equipment, secure commissioning area, pressurize and inspect system, correct faulty conditions and participate in start-up and turnover for process piping systems.	100%

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UNIT D3 HYDRAULIC SYSTEMS

Subunit: D3a Hydraulic Systems

Level: Four

Duration: 13 hours

Theory: 7 hours

Practical: 6 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of hydraulic systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with hydraulic systems.	4%
2. Explain the principles and theories of fluids. a. Pascal's law b. Bernoulli's principle	4%
3. Describe units of measure as they relate to fluids.	4%
4. Identify fluid-related formulae and describe their applications.	4%
5. Identify hazards and describe safe work practices pertaining to hydraulic systems.	4%
6. Interpret codes and regulations pertaining to hydraulic systems. a. Manufacturers' certification requirements	4%
7. Interpret information pertaining to hydraulic systems found on drawings and specifications. a. Fluid-related symbols and abbreviations	4%
8. Identify tools and equipment relating to hydraulic systems and describe their applications and procedures for use.	4%
9. Identify hydraulic system components and describe their purpose and operation. a. Pumps b. Motors c. Actuators d. Valves e. Accumulators f. Piping	4%

- g. Strainers
 - h. Supports
-
- | | | |
|------------|---|------------|
| 10. | Identify types of fluids used in hydraulic systems and describe their characteristics and applications. | 4% |
| 11. | Interpret schematics to determine the operation of hydraulic systems. | 4% |
| 12. | Describe the procedures used to install piping and components for hydraulic systems. | 4% |
| 13. | Describe the procedures used to maintain and repair piping and components for hydraulic systems. | 3% |
| 14. | Describe the procedures used to test and troubleshoot piping and components for hydraulic systems. | 3% |
| 15. | Demonstrate the procedures used to install, maintain, repair, test and troubleshoot piping and components for hydraulic systems. | 46% |

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Subunit: D3b System Testing and Commissioning II

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning of hydraulic systems.

Objectives and Content

**Percent of
Unit Mark (%)**

- | | |
|---|-------------|
| 1. Describe how to flush and chemically treat system, pre-check system and select and connect commissioning and equipment, secure commissioning area, pressurize and inspect system, correct faulty conditions and participate in start-up and turnover for hydraulic systems. | 100% |
|---|-------------|

Steamfitter-Pipefitter

UNIT D4 AIR AND PNEUMATIC SYSTEMS

Subunit: D4a Compressed Air Systems

Level: Four

Duration: 10 hours

Theory: 5 hours

Practical: 5 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of compressed air systems.

Objectives and Content:

**Percent of
Unit Mark (%)**

- | | |
|--|----|
| 1. Define terminology associated with compressed air systems. | 4% |
| 2. Identify hazards and describe safe work practices pertaining to compressed air systems. | 4% |
| 3. Interpret codes and regulations pertaining to compressed air systems.
a. American Society of Mechanical Engineers (ASME)
b. Manufacturers' certification requirements | 4% |
| 4. Interpret information found on drawings and specifications pertaining to compressed air systems. | 4% |
| 5. Identify tools and equipment relating to compressed air systems and describe their applications and procedures for use. | 4% |
| 6. Explain the principles of compressed air systems. | 4% |
| 7. Identify types of compressed air systems and describe their characteristics and applications.
a. Instrument
b. Utility
c. Process
d. Make up/breathable | 4% |
| 8. Identify compressed air system components and describe their purpose and operation.
a. Compressors
b. Piping
c. Valves
d. Controls | 4% |

- e. Supports
 - f. Receivers/tanks
 - g. Flex connectors
 - h. Auto drains
- 9. Describe the methods of air treatment in compressed air systems. 4%**
- a. Filters
 - b. Dryers
 - c. After-coolers
 - d. De-icers
- 10. Describe the procedures used to install compressed air systems and components. 4%**
- 11. Describe the procedures used to protect compressed air systems. 4%**
- 12. Describe the procedures used to maintain and repair compressed air systems and components. 3%**
- 13. Describe the procedures used to test and troubleshoot compressed air systems and components. 3%**
- 14. Demonstrate the procedures used to install, maintain, repair, test and troubleshoot compressed air systems. 50%**

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Subunit: D4b System Testing and Commissioning III

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning for air and pneumatic systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning for air and pneumatic systems.	25%
a. Documentation	
b. Drawings	
c. Related professionals	
d. Clients	
2. Describe the considerations for determining job requirements for air and pneumatic systems.	25%
a. Personnel	
b. Tools and equipment	
c. Materials	
d. Permits	
3. Describe the procedures used to plan job tasks for air and pneumatic systems.	25%
a. Scheduling	
b. Estimating	
4. Describe the procedures used to organize and maintain inventory for air and pneumatic systems.	25%

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UNIT D5 STEAM SYSTEMS (includes Pressure/High Pressure)

Subunit: D5a Intermediate Steam Review

Level: Four

Duration: 16 hours

 Theory: 16 hours

 Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Steamfitter-Pipefitter apprentice with a complete review of steam systems. After completing this unit, apprentices will be able to learn, amongst other skills, the following objectives.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Review terminology associated with steam systems.	5%
2. Review hazards and describe safe work practices pertaining to steam systems.	5%
3. Review interpretation of codes and regulations pertaining to steam systems.	5%
a. American Society of Mechanical Engineers (ASME)	5%
4. Review interpretation information pertaining to steam systems found on drawings and specifications.	
5. Review tools and equipment relating to steam systems and describe their applications and procedures for use.	5%
6. Review the applications of steam systems.	5%
a. Power generation	
b. Process	
7. Review steam system components and describe their purpose and operation.	5%
a. Boilers: fire tube, water tube	
b. Boiler trim	
c. Piping	
d. Tanks	
e. Supports	
f. Connections	
g. Expansion joints	
h. Pumps	
i. Heat transfer equipment	

- j. Steam traps; mechanical, thermostatic, thermodynamic
 - k. Valves
 - l. Water treatment equipment
-
- 8. **Review types of steam system controls and describe their purpose and operation.** 5%
 - a. Low water cut-offs (LWCO)
 - b. Operating pressure controls
 - c. High limit pressure controls
 - d. Pressure reducing valves

 - 9. **Describe the procedures used to install steam and super-heated systems, their controls and components.** 5%

 - 10. **Describe the procedures used to maintain and repair steam and super-heated systems, their controls and components.** 5%

 - 11. **Describe the procedures used to test and troubleshoot steam and super-heated systems, their controls and components.** 5%

 - 12. **Demonstrate the procedures used to install, maintain, repair, test and troubleshoot steam systems.** 45%

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Subunit: D5b System Testing and Commissioning IV

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning for steam systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning for steam systems.	25%
a. Documentation	
b. Drawings	
c. Related professionals	
d. Clients	
2. Describe the considerations for determining job requirements for steam systems.	25%
a. Personnel	
b. Tools and equipment	
c. Materials	
d. Permits	
3. Describe the procedures used to plan job tasks for steam systems.	25%
a. Scheduling	
b. Estimating	
4. Describe the procedures used to organize and maintain inventory for steam systems.	25%

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UNIT D6 Heating Ventilation Air-Conditioning and Refrigeration

SubUnit: D6a Refrigeration Systems

Level: Four

Duration: 15 hours

Theory: 15 hours

Practical: 0 hours

Overview:

Steamfitters-Pipefitters require a good, practical grasp of hydronic system control.

Objectives and Content:

Percent of Unit Mark (%)

- | | |
|---|-----|
| 1. Define terminology associated with refrigeration systems. | 10% |
| 2. Explain the refrigeration cycle. | 10% |
| 3. Identify hazards and describe safe work practices pertaining to refrigeration systems.
a. Refrigerants | 10% |
| 4. Interpret codes and regulations pertaining to refrigeration systems.
a. Certification requirements for the use of refrigerants | 10% |
| 5. Interpret information pertaining to refrigeration systems found on drawings and specifications. | 10% |
| 6. Identify types of refrigeration systems and describe their characteristics and applications.
a. Compressor systems
b. Absorption systems | 10% |
| 7. Identify refrigeration system components and describe their purpose and operation.
a. Compressors
b. Chillers
c. Evaporators
d. Valves
e. Condensers/cooling towers | 10% |
| 8. Describe the procedures used to install piping and components for refrigeration systems. | 10% |

9. Describe the procedures used to maintain and repair piping and components for refrigeration systems. 10%
10. Describe the procedures used to test and troubleshoot piping and components for refrigeration systems. 10%

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Subunit: D6b System Testing and Commissioning V

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning for refrigeration systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning for refrigeration systems.	25%
a. Documentation	
b. Drawings	
c. Related professionals	
d. Clients	
2. Describe the considerations for determining job requirements for refrigeration systems.	25%
a. Personnel	
b. Tools and equipment	
c. Materials	
d. Permits	
3. Describe the procedures used to plan job tasks for refrigeration systems.	25%
a. Scheduling	
b. Estimating	
4. Describe the procedures used to organize and maintain inventory for refrigeration systems .	25%

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UNIT D7 HEAT RECOVERY SYSTEMS

Subunit: D7a Heat Recovery Systems

Level: Four

Duration: 4 hours

Theory: 4 hours

Practical: 0 hours

Overview:

Heat recovery systems transfer heat from either ground source or deep earth by means of conduction, convection and radiation by use of closed or open loop systems. Steamfitter/pipefitters install, test, maintain, troubleshoot and repair heat recovery systems.

Steamfitters/Pipefitters are responsible for the installation and maintenance of piping, associated components and equipment for these systems. Maintenance is done on a regular schedule or on an emergency basis to ensure productivity and durability of the piping system. Steamfitters/Pipefitters are also responsible for diagnosing, locating and repairing or replacing equipment and material. Repairs are performed on an as-needed basis.

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of heat recovery systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe how to install equipment for heat recovery systems.	25%
2. Describe how to install piping for heat recovery systems.	25%
3. Describe how to test heat recovery systems.	25%
4. Describe how to maintain, troubleshoot and repair heat recovery systems.	25%

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Subunit: D7b System Testing and Commissioning VI

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning for heat recovery systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning for heat recovery systems.	25%
a. Documentation	
b. Drawings	
c. Related professionals	
d. Clients	
2. Describe the considerations for determining job requirements for heat recovery systems.	25%
a. Personnel	
b. Tools and equipment	
c. Materials	
d. Permits	
3. Describe the procedures used to plan job tasks for heat recovery systems.	25%
a. Scheduling	
b. Estimating	
4. Describe the procedures used to organize and maintain inventory for heat recovery systems.	25%

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UNIT D8 GEOTHERMAL SYSTEMS AND SOLAR HEATING SYSTEMS

Subunit: D8a Geothermal Systems and Solar Heating Systems

Level: Four

Duration: 12 hours

Theory: 12 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of geothermal systems and solar heating systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe how to install piping for geo-exchange and geo-thermal systems.	50%
2. Describe how to install, test, maintain, troubleshoot and repair solar heating systems.	50%

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Subunit: D8b System Testing and Commissioning VII

Level: Four

Duration: 2 hours

Theory: 2 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of system testing and commissioning for geothermal systems and solar heating systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning for Geothermal Systems and Solar Heating Systems.	25%
a. Documentation	
b. Drawings	
c. Related professionals	
d. Clients	
2. Describe the considerations for determining job requirements for Geothermal Systems and Solar Heating Systems.	25%
a. Personnel	
b. Tools and equipment	
c. Materials	
d. Permits	
3. Describe the procedures used to plan job tasks for Geothermal Systems and Solar Heating Systems.	25%
a. Scheduling	
b. Estimating	
4. Describe the procedures used to organize and maintain inventory for Geothermal Systems and Solar Heating Systems.	25%

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UNIT D9 COMMISSIONS SYSTEM

Subunit: D9a Quality Control

Level: Four

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of quality control.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with quality control.	10%
2. Identify hazards and describe safe work practices pertaining to quality control.	10%
3. Interpret codes and regulations pertaining to quality control.	10%
4. Interpret information pertaining to quality control found on drawings and specifications.	10%
5. Identify tools and equipment relating to quality control and describe their applications and procedures for use.	10%
6. Identify methods of non-destructive testing (NDT) and describe their associated procedures.	15%
a. Hydrostatic	
b. Pneumatic	
c. Visual	
d. Dye penetrate	
e. Magnetic particle	
f. X-ray	
g. Ultrasonic	
h. Brinell hardness	
7. Identify methods of heat treatment and stress relief and describe their associated procedures.	10%

- 8. Identify types of quality control documentation and describe their applications and procedures for use. 15%**
- a. Manuals
 - b. Daily reports
 - c. Mill test reports
 - d. Welders logs
 - e. Weld mapping
 - f. CRN registration numbers
 - g. Start-up instructions.
- 9. Explain the process, requirements and information sources for completing quality control documentation. 10%**

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Subunit: D9b Job Planning

Level: Four

Duration: 10 hours

Theory: 10 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of job planning.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning. a. Documentation b. Drawings c. Related professionals d. Clients	25%
2. Describe the considerations for determining job requirements. a. Personnel b. Tools and equipment c. Materials d. Permits	25%
3. Describe the procedures used to plan job tasks. a. Scheduling b. Estimating	25%
4. Describe the procedures used to organize and maintain inventory.	25%

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UNIT D10 JOURNEYPERSON TRAINER

Subunit: D10a Journeyperson Trainer

Level: Four

Duration: 3 hours

Theory: 3 hours

Practical: 0 hours

Overview:

Level 1 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 trade skills from one generation of trade practitioner 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 apprenticeable 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. These detailed descriptors represent suggested focal points or guidelines for potentially worthwhile exploration, and are neither mandatory nor exhaustive.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Compare/contrast role-options and responsibilities of the supervising journeyperson.	40%
a. Implicit vs. explicit standards and content: training goals are/are not codified; assessment measures are/are not used	
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.	
c. Long-term vs. short-term supervision assignments – e.g., considerable latitude/little latitude for apprentice to learn from mistakes	
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	
e. Types of supervisory role options and what is implied by each:	
• Journeyperson Trainer (JT) role: 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
- 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, such as combination or multiple roles of the above

2. Describe and demonstrate common requirements about providing journeyperson level supervision. 60%

- Apprenticeship learning adapted to journeyperson supervision assignments and a journeyperson 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 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 journeyperson, and seek advice of experienced co-workers)
 - Coverage and documentation of prescribed tasks and subtasks where applicable.
 - Discuss the limits of the journeyperson trainers' own responsibilities and competence (e.g. scope, willingness to train, etc.)
 - Benefits of maintaining a personal record of achievements, ideas, and needs as a journeyperson trainer (e.g. resume, portfolio, training credentials, logbook, etc.)
- Individual reflection and guided group discussion about personal experiences of workplace learning as an apprentice
 - Identification of best and worst practices of journeyperson trainer
 - Identification of workplace and other factors that can contribute to good and bad trades teaching/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 journeyperson trainer
 - Components of workplace journeyperson training
 - Processes and recommended practices re: journeyperson training
 - Troubleshooting problems re: supervision assignments
- 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 journeyperson-level supervision task is approached in future
- Compare and contrast discussion results with current knowledge and resources about workplace training methods as they apply to journeyperson-level supervision assignments
- Other (as may be specified by instructor)

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UNIT D11 National Requirements Review

Subunit: D11a National Requirements Review

Level: Four

Duration: 48 hours

Theory: 35 hours

Practical: 13 hours

Overview:

This unit offers senior Steamfitter-Pipefitter apprentices a systematic review of skills and knowledge required to pass the Interprovincial "Red Seal" Examination. It promotes a purposeful personal synthesis between on-the-job learning and the content of in-school technical training. The unit includes pertinent information about the broad significance of Red Seal Interprovincial certification and the main features of the Interprovincial exam. Trade-specific content is enriched with information about practical strategies/resources for mastering study materials. It is intended that apprentices who seriously tackle the objectives of this unit should be able to approach the Interprovincial exam with well-founded confidence. But the unit also promotes a consolidation of study practices, trade knowledge, and self-awareness to help meet the longer-term requirements of further learning throughout one's working life as a certified journeyman.

Objectives and Content:

**Percent of
Unit Mark (%)**

- | | |
|---|------------------|
| <p>1. Describe the significance, format, and general content of Interprovincial (Red Seal) Examinations for the trade of Steamfitter-Pipefitter trade.</p> <p>a. Scope and aims of Red Seal Interprovincial Certification system; value of certification</p> <p>b. Obligations/entitlements of candidates for Interprovincial certification
-Relevance of Interprovincial Examination to current, accepted trade practices; industry-based national validation of test items
-Re-write Policy (retesting) of Apprenticeship Manitoba
-Confidentiality of examination content; the certified journeyman's own stake in examination security (value of credential)
-Limitations on use of calculators</p> <p>c. Multiple-choice (four-option) item format; Interprovincial Red Seal/Apprenticeship Manitoba standards for acceptable test items (e.g., no "trick"-type questions; specifications for use of metric/Imperial units)</p> <p>d. Important government materials relevant to the Interprovincial Examination for apprentice construction electricians
-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 Interprovincial Examination items</p> | <p>5%</p> |
| <p>2. Identify resources, strategies, and other key considerations for maximizing successful completion of written exams used in certifying tradespeople.</p> <p>a. Personal preparedness
-Proper rest/nutrition; eye-testing</p> | <p>5%</p> |

-Making room for a personal study regimen: appropriate prior communication with family members, friends, and employers about exam-related commitments/needs; identifying – and concluding – all necessary arrangements for minimizing distractions/disruptions.

-Focused reflection on prior experience – good and bad -- in test situations (e.g., Unit Tests), especially with respect to what the apprentice already has learned about his/her own personal characteristics, learning styles, exam anxiety, and strategies (e.g., time management) for effective performance in test situations.

b. Self-assessment, consultation, and a Personal Study Plan

-Preliminary self-assessment of individual strengths/weaknesses in trade-related skills and knowledge; usefulness of old tests; usefulness of Apprenticeship Portfolio checklists and reflection on both the in-school and on-the-job components of the Apprenticeship Program in the Steamfitter-Pipefitter Trade, as well as the inter-relationship between these two components; usefulness of consultation with journeypersons, appropriate peers, the Apprenticeship Training Coordinator and/or other trade mentors

-Use(s) of approved textbooks, chapter tests, study guides, and note-taking in preparing for an examination

-Study groups: perils and possibilities

-Formulation, and submission for instructor's comments, of a personal study plan, including an approximate timetable, which describes/schedules a course of action for reviewing all relevant material(s) and for strengthening areas of deficient skills/knowledge in anticipation of the Interprovincial Red Seal Examination

3. Review basic Steamfitting-Pipefitting program content regarding: 5%

- a. Orientation I: The Structure and Scope of Steamfitter-Pipefitter Trade Learning
- b. Trade Safety Awareness
- c. Tools and Equipment
- d. Access Equipment
- e. Communications and Trade Communications
- f. Hoisting, Lifting and Rigging
- g. Mathematics/Science
- h. Pipe, Tube and Tubing Fundamentals
- i. Piping valves
- j. Copper Tube and tubing
- k. Plastic Piping
- l. Black Iron Piping
- m. Drawings and Blueprints
- n. Intro to Welding, Fuel brazing and cutting
- o. Gas code
- p. Electrical

4. Review intermediate Steamfitting-Pipefitting program content regarding: 5%

- a. Industrial drawings
- b. Template development
- c. Spool and fitting fabrication
- d. Advanced hoisting, lifting, and rigging
- e. Stainless steel piping
- f. Fiberglass piping
- g. Specialty Piping
- h. Hydronic systems
- i. Hydronic systems controls
- j. Cross connection controls
- k. Mathematics/Science II
- l. Arc welding

- 5. Review advanced Steamfitting-Pipefitting program content regarding: 9%**
- a. Low pressure steam systems
 - b. High pressure steam systems
 - c. Condensate return systems
 - d. Hydraulic systems
 - e. Compressed air systems
 - f. Medical gas and gas piping systems
 - g. Mathematics/Science III (includes heat load calculations, fan laws & pumps) and Math/Sciences IV
 - h. Refrigeration systems
 - i. Gas code II and III
 - j. Electrical II and III
 - k. Process Piping systems
 - l. System testing and commissioning
 - m. Quality Control
 - n. Job planning
- 6. Demonstrate Steamfitter-Pipefitter skills through a variety of trade projects based on your instructor's criteria. 27%**

Steamfitter-Pipefitter

UNIT: D12 MATHEMATICS IV REVIEW

Subunit: D12a Mathematics IV Review

Level: Four

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge of the imperial and metric systems, formulas and formula transposition, areas and volumes, elevations and grades, densities and pressures and offsets and percentages.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify and describe metric (S.I.) weights and measures, terms prefixes and relationships.	15%
2. Identify and describe formulas and formula transposition.	15%
3. Identify and describe the square root, perimeter and circumference.	15%
4. Identify and describe areas of rectangles, circles, triangles, trapezoids and surface areas.	15%
5. Identify and describe volumes of rectangular, cylindrical and irregular objects.	10%
6. Identify and describe Pythagora's Theorem.	10%
7. Identify and describe special right angle triangles. a. 45° b. 30° - 60° c. 22-1/2°	10%
8. Identify and describe grade. a. Simple b. Percentage c. cm/m	10%

Steamfitter-Pipefitter

UNIT D13 SCIENCE IV REVIEW

Subunit: D13a Science IV Review

Level: Four

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge of science concepts and principles related to liquids and gas, parallel offsets, and more.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify and describe density, relative density and pressure in liquids and gas (KPa).	33%
2. Identify and describe parallel offsets.	33%
3. Identify and describe simple percentage, mark-up, net profit, and gross profit.	34%

Steamfitter-Pipefitter

UNIT D14 ELECTRICAL IV

SubUnit: D14a Electrical IV

Level: Four

Duration: 27 hours

Theory: 20 hours

Practical: 7 hours

Overview:

Steamfitters-Pipefitters require a good, practical grasp of advanced level electrical content. This unit is the program gateway to further learning about these topics. Electrical theory is presented in a manner that is relevant and useful. The apprentice will learn about the basic fundamentals of electricity as related to the Gasfitter in the piping trade as core curriculum for the level 1 apprentice. The apprentice will be eligible after successful completion of level 1 electrical in the Steamfitter, and level 3 electrical in the Steamfitter, and this level 4 electrical in the Steamfitter, as core basic electrical curriculum for the associated Gasfitter program level 1, as being entrance requirements for the Gas Fitter level 2 program.

Objectives and Content:

**Percent of
Unit Mark (%)**

- | | | |
|----|---|-----------|
| 1. | Describe advanced molecular electron theory as related to conductors, insulators, semi-conductors, unstable, and stable elements. | 9% |
| 2. | Define advanced terminology, definitions, formula symbols, measurement symbols of the four properties of electricity of resistance, current, voltage, and power. | 9% |
| 3. | Define advanced terminology associated with electricity as related to the trade. | 2% |
| 4. | Defining and calculating advanced conversions of power such as watts, kilowatts, kilowatt hours, horsepower, btu's. | 2% |
| 5. | Identify the four parts to a circuit and identify advanced circuit drawing symbols as well as open, closed circuit controls. | 1% |
| 6. | Explain Ohm's law and Power law - describe advanced applications and associated calculations. | 1% |
| 7. | Explain and Identify advanced ways in which electricity is generated and how we obtain our main source of electricity from Manitoba Hydro power stations to power lines to our distribution panels. | 3% |
| 8. | Identify advanced electrical safety and recognize the three dangers of shock, arc, and blast, hazards of electricity, and describe safe work practices pertaining to electricity, including lock out/tag out, GFCI, AFCI, extension cords, fire extinguishers, disconnects, circuit breakers, fuses, guarding, bonding, grounding. | 3% |

9. **Identify advanced tools and equipment used to test electrical circuits, their category and voltage ratings, and describe their construction, applications, and procedures for use, and demonstrate proper application of each including:** 5%
- a. Polarity
 - b. Analog
 - c. Digital
 - d. Voltmeter,
 - e. Ammeter
 - f. Clamp-on ammeter
 - g. Ohmmeter
 - h. Megohmmeter
 - i. Wattmeter
 - j. Micro ammeter
 - k. Thermocouple probes
 - l. Voltage sticks
 - m. Peak and auto-ranging and true RMS measurements
10. **Describe advanced electromagnetism and Inductance (including the operation of coils), rotating magnetic fields, generator applications, stored energy (Lenz's Law), Motor principles.** 5%
11. **Describe advanced electrical fundamentals with a focus on:** 5%
- a. Defining, explaining, listing, calculating or demonstrating
 - The difference between DC and AC
 - Millivolts DC, 24 volt control circuits AC, 120 volt circuits AC, 240 volt circuits AC
 - What advantages AC has over DC in the generation, transmission and distribution systems and why it has these advantages
 - Why high voltage DC has been used for transmission of energy from distant generating stations
 - AC and DC sine waves
 - How a sinusoidal voltage is generated when a coil is rotated in a uniform magnetic field
 - b. Explaining, computing, describing, plotting, defining or comparing resistive circuits
 - The phase relationship between voltage and current in an AC circuit containing a resistance
 - The effective values of AC current and voltages
 - A power curve, the current and voltage in phase
12. **Advanced single-phase transformers.** 5%
- a. Describe the construction of a simple transformer by naming its parts and showing the interrelationships which exist to polarity and efficiency
 - b. Solve problems for an ideal transformer involving: current ratios, voltage ratios, power transfer, turns ratios, VA rating and calculating maximum loading.
13. **Identify advanced types of electrical circuits and describe their characteristics, operation and applications.** 5%
- a. Series
 - b. Parallel
 - c. Series-parallel
14. **Interpret advanced electrical related information found on ladder/schematic and pictorial/wiring drawings and specifications.** 5%
- a. Purpose of each type
 - b. Organization of each type
 - c. Symbols used for basic components

- 15. Describe the advanced function of motors and Identify their parts. 5%**
- a. DC motors
 - b. AC motors
 - c. ECM motors
- 16. Canadian Electrical code advanced. 5%**
- a. Conductor ampacities and sizing
 - b. Purpose of and sizing of bonding conductors,
 - c. Purpose of and sizing of grounding conductors
 - d. Conductor color coding and purpose
- 17. Advanced troubleshooting and critical thinking strategies. 5%**
- 18. Demonstrate advanced shop projects and hands on electrical meter usage, wiring, analyzing, and troubleshooting circuits. 25%**

Apprenticeship Manitoba

Unit **D15 GAS CODE III**

Subunit: **D15 Gas Code III**

Level: Four

Duration: 27 hours

 Theory: 20 hours

 Practical: 7 hours

Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of the Gas codes.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe B 149.2 Propane Code.	35%
2. Describe propane fundamentals.	10%
3. Demonstrate propane fundamentals as applied.	25%
4. Describe B 149.1 Section 7.	20%
5. Describe Manitoba Gas Notices.	10%
