

Steamfitter-Pipefitter Level 4

Plumber

Unit: D1 Process Piping Systems

Level: Four

Duration: 77 hours

Theory: 77 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

Unit: D2 System Testing and Commissioning

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 system testing and commissioning.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to job planning.	25%
a. documentation	
b. drawings	
c. related professionals	
d. clients	
2. Describe the considerations for determining job requirements.	25%
a. personnel	
b. tools and equipment	
c. materials	
d. permits	
3. Describe the procedures used to plan job tasks.	25%
a. scheduling	
b. estimating	
4. Describe the procedures used to organize and maintain inventory.	25%

Steamfitter-Pipefitter

Unit: D3 Quality Control

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 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	15%

and procedures for use.

- a. manuals
- b. daily reports
- c. mill test reports
- d. welders logs

9. Explain the process, requirements and information sources for completing quality control documentation.

10%

Steamfitter-Pipefitter

Unit: D4 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.	25%
a. documentation	
b. drawings	
c. related professionals	
d. clients	
2. Describe the considerations for determining job requirements.	25%
a. personnel	
b. tools and equipment	
c. materials	
d. permits	
3. Describe the procedures used to plan job tasks.	25%
a. scheduling	
b. estimating	
4. Describe the procedures used to organize and maintain inventory.	25%

Steamfitter-Pipefitter

Unit: D5 Gas Code III

Level: Four

Duration: 25 hours

Theory: 20 hours

Practical: 5 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>Unit Mark (%)</u>
1. Describe B 149.2 Propane Code.	40%
2. Describe propane fundamentals.	10%
3. Demonstrate propane fundamentals as applied.	20%
4. Describe B 149.1 Section 7.	20%
5. Describe Manitoba Gas Notices.	10%

Steamfitter-Pipefitter

Unit: D6 Electrical III

Level: Four

Duration: 30 hours

Theory: 20 hours

Practical: 10 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:	<u>Percent of Unit Mark (%)</u>
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 4 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%
5. Identify the 4 parts to a circuit and identify advanced circuit drawing symbols as well as open, closed circuit controls.	.9%
6. Explain Ohm's law and Power law - describe advanced applications and associated calculations.	.9%
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 3 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.	2.5%
9. Identify advanced tools and equipment used to test electrical circuits, their	6.7%

category and voltage ratings, and describe their construction, applications, and procedures for use, and demonstrate proper application of each including:

- 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. 6.7%

11. Describe advanced electrical fundamentals with a focus on: 6.7%

- 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. 6.7%

- 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 5%

pictorial/wiring drawings and specifications.

- 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. 6.7%

- 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. 6.7%

18. Working with advanced shop projects and hands on electrical meter usage, wiring, analyzing, and troubleshooting circuits. 33%

Steamfitter-Pipefitter

Unit: D7 Mathematics/Sciences IV Review

Level: Four

Duration: 40 hours

Theory: 40 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: **Percent of
Unit Mark (%)**

1.	Identify and describe metric (S.I.) weights and measures, terms prefixes and relationships.	9%
2.	Identify and describe formulas and formula transposition.	10%
3.	Identify and describe the square root, perimeter and circumference.	9%
4.	Identify and describe areas of rectangles, circles, triangles, trapezoids and surface areas.	10%
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.	10%
	a. 45°	
	b. 30° - 60°	
	c. 22-1/2°	
8.	Identify and describe grade.	8%
	a. simple	
	b. percentage	
	c. cm/m	
9.	Identify and describe density, relative density and pressure in liquids and gase (KPa).	8%
10.	Identify and describe parallel offsets.	8%

11.	Identify and describe simple percentage, mark-up, net profit, and gross profit.		8%

Steamfitter-Pipefitter

Unit: D8 National Requirements Review

Level: Four

Duration: 68 hours

Theory: 35 hours

Practical: 33 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 (%)**

1. **Describe the significance, format, and general content of Interprovincial (Red Seal) Examinations for the trade of Steamfitter-Pipefitter trade.** 10%
 - a. Scope and aims of Red Seal Interprovincial Certification system; value of certification
 - 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
 - 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)
 - d. Important government materials relevant to the Interprovincial Examination for apprentice construction electricians
 - Interprovincial Occupational Analysis (NOA); prescribed scope of the skills and knowledge which comprise the trade
 - NOA "Pie-chart" and its relationship to content-distribution of Interprovincial Examination items

2. **Identify resources, strategies, and other key considerations for maximizing successful completion of written exams used in certifying tradespeople.** 10%
 - a.
 - Personal preparedness
 - Proper rest/nutrition; eye-testing

- 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:** 10%
- 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:** 10%
- 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:** 11%
- 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.** 49%
