Apprenticeship Manitoba

Manitoba

# Steamfitter-Pipefitter
# Level 1

Rev. June 2011

Apprenticeship Manitoba

# Steamfitter-Pipefitter

**Unit:** **A1 Orientation I: The Structure and Scope of Steamfitter-Pipefitt Learning**

**Level:** One

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

**Overview:**

Jobsite learning and teaching have long been fundamental to Steamfitter-Pipefitter trade-practice, including its safety, health, and environmental implications. The chance to gain maximum benefit from workplace trade learning can be shaped by such complex factors as production schedules and jobsite politics. As adult trade-learners, Steamfitter-Pipefitter apprentices at all levels of skill-development are encouraged to use their eyes, ears, prior knowledge, and interpersonal skills to encourage journeypersons to teach as well as to supervise them. This requires understanding the trade's dynamics, including the roles and responsibilities that order jobsite activity. Unit content outlines the trade's skill-requirements and long-term career possibilities. It includes suggestions about trade-related learning styles/strategies. It also introduces the concept of skills stewardship, stressing the obligations that apprentices incur in learning from journeypersons to 'pay it forward' by assisting other newcomers who will follow them into the trade. The unit's purpose is to provide this essential information about learning to learn as a Manitoba Steamfitter-Pipefitter apprentice. Elsewhere in technical training, senior apprentices explore the importance of learning to teach in trade workplaces – a central function of Steamfitter-Pipefitter journeywork.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Describe the structure and scope of the trade.** | 30% |
| a. Historical background, including apprentice experiences | |
| b. Structure/scope of the trade | |
| • International and national characteristics | |
| • Important features of practicing the trade in Manitoba | |
| • Trade and construction industry organizations | |
| • Generalists and specialists | |
| • Lead hands and other immediate supervisors | |
| • Geographic mobility | |
| • Job hierarchies and innovations | |
| **2. Describe the Manitoba Steamfitter-Pipefitter apprenticeship program.** | 40% |
| a. Concept and significance of skills stewardship | |
| • To the trade | |
| • To apprentices | |

- To journeypersons
- To employers

b. Practical Training: on-site component of program
    - Roles/responsibilities of employer and journeyperson(s)
    - Roles/responsibilities of Apprenticeship Training Coordinator
    - Roles/responsibilities of apprentice, including record-keeping re: job experience
c. Technical Training: off-site component of program
    - Roles/responsibilities of instructors (including Related'-area faculty)
    - Roles/responsibilities of apprentices
d. Attendance requirements
e. Progression requirements
f. Reporting of grades
g. Other (as may be specified by instructor)

**3. Describe special opportunities and challenges re: Steamfitter-Pipefitter training.** 30%

a. Adapting personal learning goals to program contexts
    - Principles of adult learning (including importance of self-direction)
    - Description/recognition of learning and teaching styles
    - Significance of work culture and interpersonal skills re: trade-learning
    - Integrating Technical Training and Practical Training content
    - Possibilities and perils of peer learning
    - Budgeting and other necessary personal arrangements
    - Identifying sources of support (e.g., upgrading trade-related math skills)
b. On-site learning challenges and opportunities
    - Significance of jobsite supervision roles and teaching styles (e.g., journey-level skills-coach vs. mentor)
    - Communication with journeypersons and employers
    - Coverage of prescribed tasks/subtasks that define the scope of trade, and the content of the certification exam administered to apprentices who are completing their program
    - Getting help and fixing mistakes
    - Maintaining personal record of trade-learning challenges/achievements (e.g., a learning journal, and/or a personal training plan, if possible, discussed with employers and others supporting the apprenticeship journey to certification)
c. In-school opportunities/challenges
    - Personal arrangements that support progress in technical training
    - "Baggage-handling" – self-assessing potential impacts of previous experiences (favourable/unfavourable) on current learning; availability of supports
    - Techniques for note-taking, record-keeping, and review
    - Relations with instructors (including 'Related'-area faculty)
    - College resources (library, support services, etc.)

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# Steamfitter-Pipefitter

**Unit: A2 Trade Safety Awareness**

**Level:** One

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

**Overview:**

Safe working procedures and conditions, injury prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers, and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to incidents or injury. It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe, and accident-free working environment. It is imperative to apply and be familiar with the Workplace Safety and Health Act and Regulations. As well, it's essential to determine workplace hazards and take measures to protect oneself, co-workers, the public, and the environment. Safety education is an integral part of Steamfitter-Pipefitter apprenticeship training both in school and on-the-job. Unit content is supplemented throughout technical training by trade-specific information about Steamfitter-Pipefitter safety hazards and precautions presented in the appropriate contexts of discussion and study. ***Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. A "Pass/Fail" grade will be recorded for the unit. A Pass mark is assumed to be 70%. Therefore 70% is the mark to be submitted to the Apprenticeship Manitoba clerks for inputting into computer records.***

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Identify safety and health requirements.** | n/a |
| a. Overview of The Workplace Safety and Health Act<br>• Rights and responsibilities of employees under the Act<br>• Rights and responsibilities of employers under the Act<br>• Rights and responsibilities of supervisors under the Act<br>b. Fourteen (14) regulations<br>c. Codes of practice<br>d. Guidelines<br>e. Right to refuse<br>• Explanation of right to refuse process<br>• Rights and responsibilities of employees<br>• Rights and responsibilities of employers<br>• Rights and responsibilities of supervisors under the Act | |
| **2. Identify personal protective equipment (PPE) and procedures.** | n/a |

a. Employer and employee responsibilities as related to personal protective equipment.
b. Standards: ANSI (U.S.A. standards), etc.
c. Work protective clothing and danger if it fits poorly.
d. Gloves – Importance of proper glove selection (when handling chemicals, cold items, slivers, etc.)
e. Headwear – appropriate protective headwear when required and the approved type of headwear.
f. Eye protection – comparison and distinction of everyday eyeglasses, industrial safety glasses and safety goggles
g. Foot protection – when required according to safety standards
h. Hearing protection
    - Hazards of various noise levels (hearing protection must be worn)
    - Laws
    - Types of hearing protection
i. Respiratory protection – types, overview of proper selection
j. Fall protection – Manitoba requirements standards guidelines
    - ANSI (U.S.A. standards), etc.
k. Ladders and scaffolding
l. Safety principles for working with or around industrial trucks site-specific (forklifts, pallet trucks, etc.)

**3. Identify regulations pertinent to care and cleanliness in the working area.** n/a

**4. Identify the regulations relevant to the safe use of chemicals.** n/a

**5. Identify regulations governing the use of scaffolding.** n/a

**6. Identify regulations governing the use of ladders and related equipment.** n/a

**7. Identify ergonomics.** n/a

a. Definition of ergonomics and conditions that may affect the body
    - Working postures
    - Repetition
    - Force
    - Lifting
    - Tools
    - Identify tool and safety equipment
    - Causes of hand tool accidents
    - equipment

**8. Hazard recognition and control.** n/a

a. Safe work practices
b. Basic risk assessment
c. Injury prevention and control measures
d. Identification of hazards involved in pneumatic tool use and explanation of how to guard against them
e. Refrigerants
f. Toxic chemical (non-refrigerant)
g. High pressure fluids

**9. Hazard of confined space entry.** n/a

a. Identification of a confined space
b. Hazards of a confined space (including physical and biological hazards)
c. Working in a confined space
d. Emergency response plan
e. Self-contained breathing apparatus (SCBA)

**10. Identify first aid/CPR.** n/a

a. Overview of first aid regulation
b. Obligations of employers regarding first aid
    - Who is certified to provide first aid?
    - What to do while waiting for help?
    - Where is first aid kit?
c. Describe basic first aid requirements and techniques
    - Scope and limits of first aid intervention
    - Specific interventions (cuts, burns, abrasions, fractures, suffocation, shock, electrical shock, etc.)
    - What is it?
    - Interface with other services and agencies (e.g., Workers Compensation claims)
d. Describe basic CPR requirements and techniques
    - How do you get certified?
    - Scope and limits of CPR intervention (include varieties of CPR certification)

**11. Identify the safety requirements as they apply to WHMIS with emphasis on:** n/a

a. WHMIS is a system
b. Provincial regulation under the Safety and Health Act
    - Each province has a WHMIS regulation
c. Federal Hazardous Products Act
d. WHMIS generic training:
    - WHMIS defined and the format used to convey information about hazardous materials in the workplace
    - Information found on supplier and workplace labeling using WHMIS
    - Hazardous materials in accordance with WHMIS
    - Compliance with government safety standards and regulations
e. Description of WHMIS (include varieties of WHMIS Certification)
    - Typology of WHMIS labels, symbols, and classifications
    - Scope and use of Materials Safety Data Sheets (MSDS)

**12. Identifying and controlling hazards.** n/a

a. Basic control measures (injury prevention)
b. Safe work procedures
c. Explanation on the importance of industrial housekeeping
d. Employer responsibilities
e. How and where to store materials
f. Safety measures related to walkways, stairs and floor openings
g. Explanation of how to protect the worker and others when working in traffic paths

**13. Describe the safe storage of stock equipment in service vehicles.** n/a

**14. Discuss transportation of dangerous goods.** n/a

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# Steamfitter-Pipefitter

**Unit: A3 Tools and Equipment**

**Level:** One

**Duration:** 15 hours

Theory: 15 hours

Practical: 0 hours

**Overview:**

This unit introduces Steamfitter-Pipefitter apprentices to basic procedures for selecting, using, and maintaining tools and equipment in a variety of gasfitting-project settings. The principles and practical methods introduced here are pursued in greater depth and complexity throughout technical training.

| **Objectives and Content:** | | **Percent of Unit Mark (%)** |
|---|---|---|
| **1.** | **Describe use, selection, and maintenance of safety gear and personal protective equipment by Steamfitters-Pipefitters.** | 5% |
| **2.** | **Demonstrate basic techniques for use, selection, and maintenance of safety gear and personal protective equipment by Steamfitters-Pipefitters.** | 5% |
| **3.** | **Describe basic techniques for hand-tool use, selection, and maintenance by Steamfitters-Pipefitters.** | 18% |
| **4.** | **Describe the selection, use, and maintenance of power tools/equipment.** | 5% |
| **5.** | **Demonstrate basic techniques for the selection, use, and maintenance of power tools/equipment.** | 9% |
| **6.** | **Describe the selection, use, and maintenance of technical instruments, and testers, and other tools and equipment as specified by the instructor.** | 5% |
| **7.** | **Demonstrate basic techniques for the selection, use, and maintenance of technical instruments, testers, and other tools and equipment as specified by the instructor.** | 10% |
| **8.** | **Describe the selection, use, and maintenance of soldering tools and equipment.** | 10% |
| **9.** | **Demonstrate basic techniques for selection, use, and maintenance of soldering tools and equipment.** | 11% |
| **10.** | **Describe the selection, use, and maintenance of steel welding tools and equipment.** | 11% |

| | | |
|---|---|---|
| **11.** | **Demonstrate basic techniques for selection, use, and maintenance of steel welding.** | 11% |

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Apprenticeship Manitoba

# Steamfitter-Pipefitter

**Unit: A4 Access Equipment**

**Level:** One

**Duration:** 5 hours

Theory: 5 hours

Practical: 0 hours

**Overview:**

Steamfitter-Pipefitters require a good, practical grasp of access equipment. This unit of instruction is the program gateway to further learning about access equipment knowledge and skills related to ladders, scaffolding and hydraulic lifts, their applications, limitations and procedures for use.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with ladders, scaffolding and hydraulic lifts.** | 11% |
| **2. Identify hazards and describe safe work practices pertaining to ladders, scaffolding and hydraulic lifts.** | 11% |
| **3. Identify codes and regulations pertaining to ladders, scaffolding and hydraulic lifts.**<br>a. training and certification requirements | 11% |
| **4. Identify types of ladders, scaffolding and hydraulic lifts and describe their characteristics and applications.** | 11% |
| **5. Describe the procedures used to erect and dismantle ladders and scaffolding.** | 10% |
| **6. Describe the procedures used to inspect, maintain and store ladders, scaffolding and hydraulic lifts.** | 10% |
| **7. Demonstrate procedures for use of ladders, scaffolding and hydraulic lifts, their applications, and limitations.** | 36% |

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# Steamfitter-Pipefitter

## Unit: A5 Communications and Trade Documentation

**Level:** One

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

**Overview:**

Steamfitters-Pipefitters require a good, practical grasp of communication and trade documentation.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Describe the importance of effective verbal and non-verbal communication.**<br>a. other tradespersons<br>b. colleagues<br>c. supervisors<br>d. suppliers/manufacturers<br>e. clients/customers<br>f. inspectors<br>g. Sub-trades | 25% |
| **2. Identify types of communication equipment and describe their applications and procedures for use.** | 25% |
| **3. Identify types of trade related documentation and describe their applications and procedures for use.**<br>a. manufacturers' specifications<br>b. codes and standards<br>c. work orders<br>d. maintenance schedules<br>e. permits<br>f. quality control | 25% |
| **4. Explain the process, requirements and information sources for completing trade related documentation and reports.** | 25% |

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# Steamfitter-Pipefitter

## Unit: A6 Hoisting and Lifting and Rigging

**Level:** One

**Duration:** 12 hours

Theory: 12 hours

Practical: 0 hours

**Overview:**

After completing this unit, Steamfitter-Pipefitter apprentices will:

- describe and demonstrate hoisting, lifting and rigging equipment, their applications, limitations and procedures for use,
- describe and demonstrate the procedures used to perform hoisting and lifting operations, and
- describe and demonstrate calculations required when performing hoisting and lifting operations.

| Objectives and Content: | Percent of Unit Mark (%) |
|---|---|
| **1. Define terminology associated with hoisting, lifting and rigging.** | 4.7% |
| **2. Identify hazards and describe safe work practices pertaining to hoisting, lifting and rigging.** | 4.7% |
| **3. Identify codes and regulations pertaining to hoisting, lifting and rigging.** | 4.7% |
| **4. Identify types of rigging equipment and accessories and describe their limitations, applications and procedures for use.** | 4.7% |
| **5. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.** | 4.7% |
| **6. Describe the procedures used to inspect, maintain and store hoisting, lifting and rigging equipment.** | 4.7% |
| **7. Identify types of knots, hitches and bends and describe their applications and the procedures used to tie them.** | 4.7% |
| **8. Describe the procedures used to rig material/equipment for lifting.** | 4.7% |
| **9. Describe the procedures used to ensure the work area is safe for lifting.**<br>a. supervision of lift<br>b. securing work area<br>c. communication | 4.7% |

**10. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.** 4.7%

a. hand signals
b. electronic communications
c. audible/visual

**11. Explain sling angle when preparing for hoisting and lifting operations.** 4.7%

**12. Identify the factors to consider when selecting rigging equipment** 4.7%

a. load characteristics
b. environment
c. safety factor

**13. Describe the procedures used for attaching rigging equipment to the load.** 4.7%

**14. Describe the procedures used to perform a lift.** 4.9%

a. load determination
b. communication methods
c. pre-lift checks
d. placement of load
e. post-lift inspection

**15. Demonstrate the procedures used to perform hoisting and lifting operations.** 17%

**16. Demonstrate calculations required when performing hoisting and lifting operations.** 17%

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# Steamfitter-Pipefitter

**Unit: A7 Mathematics/Science I**

**Level:** One

**Duration:** 40 hours

Theory: 40 hours

Practical: 0 hours

**Overview:**

This unit of instruction 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 as well as such science topics as metals and alloys, and hydrodynamics, hydrostatics and pneumatics.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Identify and describe metric (s.i.) and imperial weights and measures, decimals and fractions, terms prefixes and relationships.** | 5% |
| **2. Identify and describe formulas and formula transposition.** | 5% |
| **3. Identify and describe the square root, perimeter and circumference.** | 5% |
| **4. Identify and describe areas of rectangles, circles, triangles, trapezoids and surface areas.** | 5% |
| **5. Identify and describe volumes of rectangular, cylindrical and irregular objects.** | 5% |
| **6. Identify and describe Pythagora's theorem.** | 5% |
| **7. Identify and describe special right angle triangles:**<br>a. 45°<br>b. 30° - 60°<br>c. 22-1/2° | 4% |
| **8. Identify and describe grade:**<br>a. simple<br>b. percentage<br>c. cm/m/inches/ft. | 4% |
| **9. Identify and describe density, relative density and pressure in liquids and gases (kpa) as well as Charle's and Boyle's gas laws.** | 4% |

**10. Identify and describe parallel offsets.** 4%

**11. Identify and describe simple percentage, mark-up, net profit, gross profit.** 4%

**12. Describe with respect to sciences metals and alloys:** 20%

a. Define metals, alloys, conduction, melting point, specific heat, linear expansion, ductility, shear strength, tensile strength, compressive strength, working(safe) strength, malleable, ferrous, non-ferrous ,anneal, harden, temper.
b. Identify the most common metals
c. Identify the most common alloys
d. Define cost effectiveness
e. Identify and describe properties of metals
f. Identify and describe problems in linear expansion
g. Identify and describe bi-metal strip and its uses
h. Identify and describe various solder
i. Identify and describe wrought iron
j. Identify and describe corrosion (oxidation): chemical and electrochemical
k. Identify and describe methods in preventing corrosion
l. Identify and describe galvanic series
m Identify and describe factors aiding corrosion
n. Identify and describe corrosion resistant materials

**13. Describe with respect to sciences hydrodynamics, hydrostatics and pneumatics:** 20%

a. Define hydrodynamics, hydrostatics, pneumatics, fluids, viscosity, adhesion, cohesion, capillary action, relative density, pressure (psi, psia, pascals, head).
b. Total pressure, transmission of pressure, vacuum, partial vacuum, siphon, manometer, buoyancy, laminar flow, turbulent flow, pitot tube, velocity head, venturi, bernoulli's theorem, hydraulic ram, water hammer, cavitation.
c. Identify and describe plumbing systems
d. Identify and describe flow of liquids and gases
e. Identify and describe pressurized systems
f. Identify and describe hydraulic jacks and presses
g. Identify and describe thrust blocks
h. Identify and describe air chambers
i. Identify and describe pumps
j. Identify and describe syphons
k. Identify and describe velocity head
l. Identify and describe bourdon type pressure gauge
m. Identify and describe uses of buoyance
n. Identify and describe conversion of fps to gpm and gpm to fps, m/s to i/s and i/s to m/s
o. Identify and describe flow in venturis
p. Identify and describe Bernoulli's theorem applied
q. Identify and describe Charle's. and Boyle's gas laws

**14. Describe heat load calculations, fan laws and pumps.** 10%

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# Steamfitter-Pipefitter

## Unit: A8 Pipe, Tube and Tubing and Fundamentals

**Level:** One
**Duration:** 21 hours
Theory: 21 hours
Practical: 0 hours

**Overview:**

Upon completion of this unit of instruction apprentices will be able to show understanding of pipe, tube and tubing and fundamentals related to Steamfitter-Pipefitter situations.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with pipe, tube and tubing.** | 12% |
| **2. Identify types of pipe, tube and tubing systems.**<br>a. water supply<br>b. sanitary drainage, waste and vent<br>c. storm drainage<br>d. heating<br>e. sprinkler<br>f. gas<br>g. process and power generating<br>h. refrigeration<br>i. compressed air | 12% |
| **3. Identify types of pipe, tube and tubing and describe their applications.**<br>a. steel<br>b. plastic<br>c. copper<br>d. brass<br>e. aluminum<br>f. cast iron: ductile, duriron and grey.<br>g. historic<br>h. glass<br>i. asbestos-cement<br>j. reinforced concrete<br>k. stainless steel<br>L fiberglass | 11% |
| **4. Explain forces that impact on pipe, tube and tubing systems and perform** | 11% |

**associated calculations.**

a. thermal expansion
b. thermal contraction
c. weight
d. friction loss
e. turbulence
f. galvanic action
g. environmental

**5. Describe calculations to determine pipe, tube and tubing measurements.** 27%

a. run and branch
b. fitting allowances
c. offsets including travel, rise and run, rolling, equal spread, unequal spread

**6. Describe pipe, tube and tubing applications.** **27%**

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# Steamfitter-Pipefitter

**Unit:** **A9 Piping Valves**

**Level:** One

**Duration:** 10 hours

Theory: 10 hours

Practical: 0 hours

**Overview:**

This unit of instruction is designed to provide the Steamfitter-Pipefitter with the knowledge and understanding of piping valves. After completing this unit, apprentices will be able to learn, amongst other skills, the following objectives.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with piping valves.** | 7% |
| **2. Identify hazards and describe safe work practices pertaining to piping valves.** | 7% |
| **3. Interpret codes, regulations and standards pertaining to piping valves.** | 7% |
| **4. Interpret information found on drawings and specifications pertaining to piping valves.** | 7% |
| **5. Identify tools and equipment relating to piping valves and describe their applications and procedures for use.** | 7% |
| **6. Identify types of piping valves and describe their characteristics, operation and applications.**<br>a. gate<br>b. globe<br>c. ball<br>d. plug<br>e. butterfly<br>f. check<br>g. relief<br>h. pop safety<br>i. pressure reducing<br>j. float operated<br>k. diaphragm<br>l. mixing | 7% |

| | | |
|---|---|---|
| **7.** | **Identify types of valve actuators and describe their purpose.**<br>a. electric<br>b. pneumatic<br>c. manual | 7% |
| **8.** | **Explain piping valve rating systems.**<br>a. pressure<br>b. temperature | 7% |
| **9.** | **Identify the methods used to join piping valves and describe their associated procedures.** | 7% |
| **10.** | **Describe the procedures used to install piping valves.** | 7% |
| **11.** | **Describe the procedures used to maintain and repair piping valves.** | 5% |
| **12.** | **Describe the procedures used to test and troubleshoot piping valves.** | 5% |
| **13.** | **Demonstrate the procedures used to install, maintain, repair, test and troubleshoot piping valves.** | 20% |

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# Steamfitter-Pipefitter

**Unit:** **A10 Copper Tube and Tubing**

**Level:** One

**Duration:** 32 hours

Theory: 12 hours

Practical: 20 hours

**Overview:**

This unit of instruction is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of copper tube and tubing.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with copper tube and tubing.** | 3% |
| **2. Identify hazards and describe safe work practices pertaining to copper tube and tubing.** | 3% |
| **3. Interpret codes and regulations pertaining to copper tube and tubing.** | 3% |
| **4. Interpret information pertaining to copper tube and tubing found on drawings and specifications.** | 3% |
| **5. Describe the identification systems and methods for copper tube and tubing.** | 3% |
| **6. Identify tools and equipment relating to copper tube and tubing and describe their applications and procedures for use.** | 3% |
| **7. Identify copper tube and tubing systems and describe their characteristics and applications.** | 3% |
| **8. Identify types of copper tube and tubing and describe their properties and characteristics.** | 3% |
| **9. Identify fittings used with copper tube and tubing and describe their purpose and applications.** | 3% |
| **10. Identify copper tube and tubing accessories and describe their purpose and applications.**<br>a. supports | 3% |

b. hangers
c. sleeves

**11. Explain the systems of measurement for copper tube and tubing.** 3%
a. dimension
b. length
c. wall thickness/schedule

**12. Describe the procedures used to measure copper tube and tubing.** 3%

**13. Perform calculations to determine copper tube and tubing measurements.** 3%
a. run and branch
b. fitting allowances
c. offsets

**14. Describe the procedures used to inspect copper tube and tubing.** 3%

**15. Identify the methods used to cut copper tube and tubing and describe their associated procedures.** 3%

**16. Describe the procedures used to bend copper tube and tubing.** 3%

**17. Identify the methods used to join copper tube and tubing and describe their associated procedures.** 3%
a. brazing
b. soldering
c. flaring
d. roll groove
e. compression fittings
f. mechanical joints

**18. Describe the procedures used to install fittings and accessories for copper tube and tubing.** 3%

**19. Demonstrate the procedures used to measure, cut and join copper tube and tubing.** 49%

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# Steamfitter-Pipefitter

**Unit:** **A11 Plastic Piping**

**Level:** One

**Duration:** 12 hours

Theory: 7 hours

Practical: 5 hours

**Overview:**

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

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with plastic piping.** | 3% |
| **2. Identify hazards and describe safe work practices pertaining to plastic piping.** | 3% |
| **3. Interpret codes and regulations pertaining to plastic piping.** | 3% |
| **4. Interpret information pertaining to plastic piping found on drawings and specifications.** | 3% |
| **5. Describe the identification systems and methods for plastic piping.** | 3% |
| **6. Identify tools and equipment relating to plastic piping and describe their applications and procedures for use.** | 3% |
| **7. Identify plastic piping systems and describe their characteristics and applications.** | 3% |
| **8. Identify types of plastic piping and describe their properties and characteristics.**<br>a. thermoset<br>b. thermoplastic | 3% |
| **9. Identify fittings used with plastic piping and describe their purpose and applications.** | 3% |
| **10. Identify plastic piping accessories and describe their purpose and applications.** | 3% |

a. supports
b. hangers
c. sleeves

**11. Explain the systems of measurement for plastic piping.** 3%
a. dimension
b. length
c. wall thickness/schedule

**12. Describe the procedures used to measure plastic piping.** 3%

**13. Perform calculations to determine plastic piping measurements.** 3%
a. run and branch
b. fitting allowances
c. offsets

**14. Describe the procedures used to inspect plastic piping.** 3%

**15. Identify the methods used to cut plastic piping and describe their associated procedures.** 3%

**16. Identify the methods used to join plastic piping and describe their associated procedures.** 3%
a. heat fusion welding
b. threading
c. solvent welding
d. compression fittings
e. mechanical joints

**17. Describe the procedures used to install fittings and accessories for plastic piping.** 3%

**18. Demonstrate the procedures used to measure, cut and join plastic piping.** 49%

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# Steamfitter-Pipefitter

**Unit: A12 Black Iron Piping**

**Level:** One

**Duration:** 65 hours

Theory: 30 hours

Practical: 35 hours

**Overview:**

This unit of instruction is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of black iron piping.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with black iron piping.** | 2% |
| **2. Identify hazards and describe safe work practices pertaining to black iron piping.**<br>a. galvanized pipe | 2% |
| **3. Interpret codes and regulations pertaining to black iron piping.** | 2% |
| **4. Interpret information pertaining to black iron piping found on drawings and specifications.** | 2% |
| **5. Describe the identification systems and methods for black iron piping.** | 2% |
| **6. Identify tools and equipment relating to black iron piping and describe their applications and procedures for use.** | 2% |
| **7. Identify cast iron systems and describe their characteristics and applications.** | 2% |
| **8. Identify fittings used with black iron piping and describe their purpose and applications.** | 3% |
| **9. Identify cast iron accessories and describe their purpose and applications.**<br>a. supports<br>b. hangers<br>c. sleeves | 3% |
| **10. Explain the systems of measurement for cast iron.**<br>a. dimension | 3% |

b. length
c. wall thickness/schedule

**11. Describe the procedures used to measure black iron piping.** 3%

**12. Describe the procedures used to inspect black iron piping.** 4%

**13. Identify the methods used to cut black iron piping and describe their associated procedures.** 4%

**14. Identify the methods used to join black iron piping and describe their associated procedures.** 4%
a. threaded
b. grooved
c. welded
d. flanged
e. press-fit
f. compression fittings

**15. Describe the procedures used to install fittings and accessories for black iron piping.** 4%

**16. Demonstrate the procedures used to measure, cut and join black iron piping.** 58%

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Apprenticeship Manitoba

# Steamfitter-Pipefitter

**Unit:** **A13 Drawings and Blueprints**

**Level:** One

**Duration:** 30 hours

Theory: 30 hours

Practical: 00 hours

**Overview:**

Steamfitter-Pipefitters require a good, practical grasp of project design basics, as well as the ability to use technical drawings for a variety of trade tasks. Technical drawing is medium for exploring built structures in detail, as well as a tool for developing new ideas and solving problems. This unit of instruction is the program gateway to further learning about construction-project design variations, technical drawing, and blueprint-reading skills. The unit also offers Steamfitter-Pipefitter apprentices a chance to apply some of the techniques, procedures, and conventions used in professional drafting and design. Elsewhere in technical training, apprentices will refine their skills in the use of trade documents through hands-on work with a variety of construction-project blueprints.

This unit of instruction is also designed to reinforce and further enhance the techniques of sketching and drawing to reinforce the procedures of blueprint reading, relying on the principles, symbols and convention, and to give the student a technical interpretation or orthographic drawings and develop a relationship between simple object forms and a set of normal building trade drawings.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with drawings and sketches.** | 5% |
| **2. Describe metric and imperial systems of measurement and the procedures used to perform conversions.** | 5% |
| **3. Identify the types of drawings and describe their applications.**<br>a. civil/site<br>b. architectural<br>c. mechanical<br>d. structural<br>e. electrical<br>f. shop drawings<br>g. sketches | 5% |
| **4. Identify types of symbols and describe their characteristics and applications.** | 5% |

**5. Identify drawing projections and views and describe their applications.** 5%

a. change orders
b. addendums
c. as-builts
d. specifications

**6. Identify drawing projections and views and describe their applications.** 5%

a. projections (orthographic, oblique, isometric)
b. views (plan, section, detail, elevation, cross section)

**7. Describe the use of scales.** 5%

**8. Describe the procedures used for the care, handling and storage of drawings.** 5%

**9. Describe Steamfitter-Pipefitter and gas layout drawings.** 5%

**10. Interpret information on drawings.** 5%

a. lines
b. legend
c. symbols and abbreviations
d. noted and specifications
e. schedules
f. scales

**11. Demonstrate the procedures used for the care, handling and storage of drawings.** 5%

**12. Demonstrate basic sketching techniques.** 5%

**13. Demonstrate basic Steamfitter-Pipefitter and gas layout drawings.** 5%

**14. Construct with the use of drafting instruments an accurate isometric or orthographic drawing of a piping system using the correct line and piping symbols.** 5%

**15. Construct using acceptable techniques an isometric or orthographic sketch of a piping system using the correct line and piping symbols. The finished sketch to be of approximately the correct shape and proportions.** 5%

a. isometric sketching and drawing
b. orthographic sketching and drawing
c. line symbols
d. piping symbols

**16. Describe how to relate a typical set(s) of building trade drawings to the orthographic drawing system and by doing so obtain required information from the various plans elevations, sections and details in the four major divisions within a set of building trade drawings (i.e., architectural, structural, mechanical and electrical).** 5%

**17. Describe how to extract correctly basic information from a typical set of specification (i.e. fixture types, hangers and supports, types of pipe and fittings for various services, etc.):Theory of sections, development of** 10%

**relationship from simple orthographic drawings to build trade drawings, and blueprint reading of suitable, available building, trade drawings and specification.**

| | | |
|---|---|---|
| **18.** | **Given a set of architectural drawings produce a working set of steamfitter-pipefitter drawings as related to the mechanical section of building trade drawings, describe how to: (a) Interpret and extract architectural and structural information from blueprints by having the steamfitter-pipefitter system conform to the conditions of the building (beams, ceiling spaces, etc.) (T), (b) Use the correct line and piping symbols for showing rain water leaders, storm sewer, sanitary sewer, vents, cold water, hot water and recirculated hot water lines (P), (c) Interpret site plan information by connecting building services to street mains, including the calculation of satisfactory invert elevations of storm and sanitary drains at the building line (T), (d) Indicate specification references by identifying each different plumbing fixture by a "P-number" system. (T), (e) Use her/his code tables with reference to an actual building condition in calculating storm sewer (roof area) sizes and sanitary sewer and vent (fixture unit count) sizes. (T), (f) Construct accurate isometric drawings of washroom groups from orthographic piping layouts (floor plans). (P) (g) Production of a working set of building drawings in the students' trade area. (P)** | 10% |

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Apprenticeship Manitoba

# Steamfitter-Pipefitter

## Unit: A14 Introduction to Welding, Fuel Brazing and Cutting

**Level:** One

**Duration:** 22 hours

Theory: 7 hours

Practical: 15 hours

**Overview:**

Steamfitter-Pipefitter's require a good, practical grasp of welding, fuel brazing and cutting. This unit is the program gateway to further your welding, fuel brazing and cutting skills.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Define terminology associated with welding.** | 2% |
| **2. Identify hazards and describe safe work practices pertaining to welding**<br>a. personal<br>b. workplace | 2% |
| **3. Interpret codes and regulations pertaining to welding.**<br>a. Certification requirements | 2% |
| **4. Interpret information pertaining to welding found on drawings and specifications.**<br>a. symbols and abbreviations | 2% |
| **5. Describe the properties and characteristics of metals.**<br>a. metal inert gas (MIG),<br>• gas metal arc welding (GMAW)<br>• flux core arc welding (FCAW)<br>b. tungsten inert gas (TIG)<br>c. electric welding/shielded metal arc welding (SMAW) | 2% |
| **6. Identify types of welding equipment and describe their associated components, accessories and consumables.** | 2% |
| **7. Identify basic weld joints and describe their applications.** | 2% |
| **8. Describe the procedures used to set up and adjust welding equipment.** | 2% |
| **9. Describe the procedures used to tack weld.** | 2% |

| | | |
|---|---|---|
| **10.** | **Describe the procedures used to maintain and store welding equipment, their components, accessories and consumables.** | 2% |
| **11.** | **Demonstrate the procedures used to set up and adjust welding equipment.** | 23% |
| **12.** | **Demonstrate tack weld procedures.** | 23% |
| **13.** | **Define terminology associated with fuel brazing and cutting.** | 1% |
| **14.** | **Identify hazards and describe safe work practices pertaining to fuel brazing and cutting.**<br>a. personal<br>b. workplace | 1% |
| **15.** | **Interpret codes and regulations pertaining to fuel brazing and cutting.** | 1% |
| **16.** | **Identify types of fuel brazing and cutting equipment and describe their components and applications.**<br>a. air-propane<br>b. air-acetylene<br>c. oxy-propane<br>d. oxy-acetylene | 1% |
| **17.** | **Identify fuel brazing and cutting equipment accessories and describe their applications and procedures for use.** | 1% |
| **18.** | **Describe the procedures used to set-up, adjust and shut-down fuel cutting and brazing equipment.** | 1% |
| **19.** | **Describe the procedures used to cut materials using fuel cutting equipment.** | 1% |
| **20.** | **Identify cutting faults and describe the procedures to prevent and correct them.** | 1% |
| **21.** | **Describe the procedures used to braze materials using fuel brazing equipment.** | 1% |
| **22.** | **Describe the procedures used to inspect and maintain fuel cutting and brazing equipment.** | 1% |
| **23.** | **Describe the procedures used to transport and store fuel cutting and brazing equipment.** | 1% |
| **24.** | **Demonstrate the procedures used to cut and braze materials using fuel brazing and cutting equipment.** | 23% |

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Apprenticeship Manitoba

# Steamfitter-Pipefitter

**Unit: A15 Gas Code**

**Level:** One

**Duration:** 20 hours

Theory: 20 hours

Practical: 0 hours

**Overview:**

This unit of instruction is designed to provide the Steamfitter-Pipefitter apprentice with the basic knowledge and understanding of gas code.

| **Objectives and Content:** | | **Percent of Unit Mark (%)** |
|---|---|---|
| **1.** | **Define terminology associated with gas code.** | **10%** |
| **2.** | **Identify hazards and describe safe work practices pertaining to gas code.** | **10%** |
| **3.** | **Interpret codes and regulations pertaining to gas.** | **10%** |
| **4.** | **Interpret information pertaining to gas found on drawings and specifications.** | **10%** |
| **5.** | **Describe the identification systems and methods for gas.** | **10%** |
| **6.** | **Identify tools and equipment relating to gas and describe their applications and procedures for use.** | **10%** |
| **7.** | **Identify gas systems and describe their characteristics and applications.** | **10%** |
| **8.** | **Identify types of gas and describe their properties and characteristics.** | **10%** |
| **9.** | **Explain the systems of measurement for gas.** | **10%** |
| **10.** | **Describe the procedures used to install fittings and accessories for steel piping.** | **10%** |

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Apprenticeship Manitoba

# Steamfitter-Pipefitter

## Unit: A16 Electrical Fundamentals

**Level:** One

**Duration:** 10 hours

Theory: 10 hours

Practical: 0 hours

**Overview:**

Steamfitter-Pipefitters require a good, practical grasp of electricity. This unit of instruction is the program gateway to further learning about this topic. Electrical theory is presented in a manner that is relevant and useful. The apprentice will learn a basic overview of the fundamentals of electricity.

| **Objectives and Content:** | **Percent of Unit Mark (%)** |
|---|---|
| **1. Describe basic molecular electron theory as related to conductors, insulators.** | 5% |
| **2. Define the basic terminology, definitions, formula symbols, measurement symbols of the 4 properties of electricity of resistance, current, voltage, and power.** | 5% |
| **3. Define basic terminology associated with electricity as related to the trade.** | 5% |
| **4. Identify the basic 4 parts to a circuit and identify circuit drawing symbols as well as open, closed circuit controls.** | 5% |
| **5. Explain Ohm's law and Power law - describe basic applications and associated calculations.** | 5% |
| **6. Identify basic 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, extension cords, fire extinguishers, disconnects, circuit breakers, fuses, guarding, bonding, grounding.** | 15% |
| **7. Identify basic 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:**<br>a. voltmeter<br>b. ammeter<br>c. clamp-on ammeter<br>d. ohmmeter | 10% |
| **8. Identify basic types of electrical circuits and describe their characteristics,** | 35% |

**operation and applications.**

a. series
b. parallel
c. series-parallel

**9. Interpret basic electrical related information found on ladder/schematic and pictorial/wiring drawings and specifications.** 15%

a. purpose of each type
b. organization of each type
c. symbols used for basic components

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