

Plumber Level 4

Plumber

UNIT: D1 COMMUNICATION TECHNIQUES AND MENTORING

Subunit: D1a Journeyperson Trainer

Level: Four

Duration: 5 hours

Theory: 5 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.	50%
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. 50%

- a. 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.)
- b. 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
- c. Role of assessment in supervising, coaching, or guiding other people to learn or improve their skills (e.g. formative and summative evaluation), and how this might contribute to how the journeyperson-level supervision task is approached in future
- d. Compare and contrast discussion results with current knowledge and resources about workplace training methods as they apply to journeyperson-level supervision assignments
- e. Other (as may be specified by instructor)

Plumber

Subunit: D1b Communication and Trade Documentation

Level: Four

Duration: 15 hours

Theory: 15 hours

Practical: 0 hours

Overview:

Plumbers require a good, practical grasp of communication and trade documentation. This unit of instruction is the program gateway to further learning about these topics.

Objectives and Content:

**Percent of
Unit Mark (%)**

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| 1. Describe the importance of effective verbal and non-verbal communication. | 25% |
| a. Other tradespersons | |
| b. Colleagues | |
| c. Supervisors | |
| d. Suppliers/manufacturers | |
| e. Clients/customers | |
| f. Inspectors | |
| g. Engineers | |
| 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. | 25% |
| a. Manufacturers' specifications | |
| b. Codes and standards | |
| c. Work orders | |
| d. Maintenance schedules | |
| e. Permits | |
| f. Quality control | |
| 4. Explain the process, requirements and information sources for completing trade related documentation and reports. | 25% |

Plumber

Subunit: D1c Job Planning

Level: Four

Duration: 5 hours

Theory: 5 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with the basic knowledge and understanding of job planning.

Objectives and Content:

Percent of Unit Mark (%)

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| 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% |

Plumber

UNIT: D2 SEWAGE TREATMENT SYSTEMS

Subunit: D2a Private Sewage Disposal Systems

Level: Four

Duration: 25 hours

Theory: 20 hours

Practical: 5 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with the basic knowledge and understanding of private sewage disposal systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with private sewage disposal systems.	5%
2. Identify hazards and describe safe work practices pertaining to private sewage disposal systems. a. Health hazards b. Environmental hazards	5%
3. Interpret codes and regulations pertaining to private sewage disposal systems.	5%
4. Interpret information pertaining to private sewage disposal systems found on drawings and specifications.	5%
5. Identify tools and equipment relating to private sewage disposal systems and describe their applications and procedures for use.	5%
6. Identify types of private sewage disposal systems and describe their characteristics and applications.	5%
7. Identify private sewage disposal system components and describe their purpose and applications. a. Septic tank b. Disposal field c. Lift pumps d. Holding tanks e. Bio filter	5%

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| 8. Identify the factors to consider when planning and installing private sewage disposal systems | 5% |
| a. Location: system position, clearances, and relation to water table | |
| b. Soil conditions/properties: percolation test and soil test | |
| 9. Identify the factors to consider when sizing private sewage disposal system components. | 5% |
| 10. Describe the procedures used to size private sewage disposal system Components. | 5% |
| 11. Describe the procedures used to install private sewage disposal systems. | 5% |
| 12. Describe the procedures used to protect private sewage disposal systems. | 5% |
| 13. Describe the procedures used to maintain and repair private sewage disposal systems. | 5% |
| 14. Describe the procedures used to test and troubleshoot private sewage disposal systems. | 5% |
| 15. Demonstrate the procedures used to install, maintain, repair, test and troubleshoot private sewage disposal systems. | 30% |

Plumber

UNIT: D3 PRESSURE SYSTEMS

Subunit: D3a Water Treatment Systems

Level: Four

Duration: 35 hours

Theory: 20 hours

Practical: 15 hours

Overview:

Plumbers require a good, practical grasp of water treatment systems. This unit of instruction is the program gateway to further learning about these topics.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with water treatment systems.	5%
2. Identify hazards and describe safe work practices pertaining to water treatment systems.	5%
3. Interpret codes and regulations pertaining to water treatment systems.	5%
4. Interpret information pertaining to water treatment systems found on drawings and specifications.	5%
5. Identify tools and equipment relating to water treatment systems and describe their applications and procedures for use.	5%
6. Identify types of water problems and describe their characteristics and causes. a. Hardness b. Minerals a. Contamination/pollution b. pH a. Taste/odor b. Turbidity	5%
7. Identify types of water tests and describe their associated procedures.	5%
8. Interpret results of water tests to determine water treatment requirements.	5%
9. Identify methods of water treatment and describe their characteristics and applications. a. Filters	5%

- b. Softeners
- c. Purifiers
- d. Chemical feeders
- e. Sterilizers
- f. Reverse osmosis
- g. De-ionizers
- h. Neutralizers
- i. Distillers
- j. UV disinfection

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| 10. | Identify water treatment components and describe their applications and operation. | 5% |
| 11. | Describe the procedures used to install water treatment systems and components. | 5% |
| 12. | Describe the procedures used to protect water treatment systems and components. | 5% |
| 13. | Describe the procedures used to maintain and repair water treatment systems and components. | 5% |
| 14. | Describe the procedures used to test and troubleshoot water treatment systems and components. | 5% |
| 15. | Demonstrate the procedures used to install, maintain, repair, test and troubleshoot water treatment systems. | 30% |

Plumber

UNIT: D4 LOW PRESSURE STEAM SYSTEMS

Subunit: D4a Low Pressure Steam Systems

Level: Four

Duration: 25 hours

Theory: 20 hours

Practical: 5 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with knowledge and understanding of advanced low pressure steam systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with low pressure steam systems.	7%
2. Identify hazards and describe safe work practices pertaining to low pressure steam systems.	7%
3. Interpret codes and regulations pertaining to low pressure steam systems.	7%
4. Interpret information pertaining to low pressure steam systems found on drawings and specifications.	7%
5. Identify tools and equipment relating to low pressure steam systems and describe their applications and procedures for use.	7%
6. Identify types of low pressure steam systems and describe their characteristics and applications. a. Heating b. Process	7%
7. Identify low pressure steam system components and describe their purpose and operation. a. Boilers b. Piping c. Connections d. Traps: mechanical, thermostatic, thermodynamic e. Pumps f. Heat transfer equipment	7%

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| 8. Identify types of low pressure steam system controls and describe their purpose and operation. | 7% |
| a. Valves: pressure relief/safety, pressure reducing, boiler stop, blow off | |
| b. Steam pressure gauges | |
| c. Glass water column | |
| d. Fusible plugs | |
| e. Feed water | |
| f. Low water cut-off | |
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| 9. Describe the procedures used to install low pressure steam systems and controls. | 7% |
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| 10. Describe the procedures used to protect low pressure steam systems and controls. | 7% |
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| 11. Describe the procedures used to maintain and repair low pressure steam systems and controls. | 7% |
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| 12. Describe the procedures used to test and troubleshoot low pressure steam systems and controls. | 9% |
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| 13. Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot low pressure steam systems. | 14% |

Plumber

UNIT: D5 SPECIALIZED SYSTEMS II

Subunit: D5a Specialized Systems II

Level: Four

Duration: 30 hours

Theory: 30 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with the knowledge and understanding of specialized systems with a focus on fuel systems, and medical gas systems.

Fuel Systems Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe piping for specialized systems with a focus on fuel systems.	7%
2. Describe equipment and components for specialized systems with a focus on fuel systems.	7%
3. Describe testing of specialized systems with a focus on fuel systems.	7%
4. Describe servicing of specialized systems with a focus on fuel systems.	7%
Medical Gas Objectives and Content:	<u>Percent of Unit Mark (%)</u>
5. Define terminology associated with medical gas systems.	6%
6. Identify hazards and describe safe work practices pertaining to medical gas systems.	6%
7. Interpret codes and regulations pertaining to medical gas systems.	6%
a. Diameter Index Safety System (DISS)	
b. Pin indexing system	
8. Interpret information pertaining to medical gas systems found on drawings and specifications.	6%
9. Identify tools and equipment relating to medical gas systems and describe their applications and procedures for use.	6%
10. Identify types of medical gases and describe their characteristics.	6%

- a. Oxygen
 - b. Nitrogen
 - c. Nitrous oxide/aesthetic
 - d. Medical air
 - e. Vacuum
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- 11. **Identify medical gas system equipment, components and accessories and describe their applications and operation.** **6%**
 - a. Vacuum pumps
 - b. Medical air compressors
 - c. Piping
 - d. Valves
 - e. Alarms
 - f. Sensors
 - g. Oxygen concentrators

 - 12. **Identify the considerations for selecting components and accessories for medical gas systems.** **6%**

 - 13. **Describe the procedures used to install medical gas systems.** **6%**

 - 14. **Describe the procedures used to protect medical gas systems.** **6%**

 - 15. **Describe the procedures used to maintain and repair medical gas systems.** **6%**

 - 16. **Describe the procedures used to test and troubleshoot medical gas systems.** **6%**

Plumber

UNIT: D6 PROCESS PIPING

Subunit: D6a Process Piping

Level: Four

Duration: 15 hours

Theory: 15 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with the knowledge and understanding of process piping.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe installation of piping for process piping systems.	25%
2. Describe installation of equipment and components for process piping systems.	25%
3. Describe testing of process piping systems.	25%
4. Describe servicing process piping systems.	25%

Plumber

Unit: D7 PRE-IP TRADE MATHEMATICS IV AND SCIENCE REVIEW

Subunit: D7a Pre-IP Trade Mathematics IV and Science Review

Level: Four

Duration: 35 hours

Theory: 35 hours

Practical: 0 Hours

Mathematics Overview:

This unit of instruction is designed to provide the Plumbing 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.

Mathematics Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify and describe metric (S.I.) weights and measures, terms prefixes and relationships.	4%
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 Pythagoras's Theorem.	5%
7. Identify and describe special right angle triangles.	4%
a. 45°	
b. 30° - 60°	
c. 22-1/2°	
8. Identify and describe grade.	4%
a. Simple	
b. Percentage	
c. cm/m	
9. Identify and describe density, relative density and pressure in liquids and gases (KPa).	5%

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| 10. Identify and describe parallel offsets. | 4% |
| 11. Identify and describe simple percentage, mark-up, net profit, gross profit. | 4% |

Science Overview:

As necessary, the apprentice will review the materials from Level 1 metals and alloys and the principles of hydrodynamics, hydrostatics and pneumatics and be able to relate same to plumbing problems.

S/he might also review the materials from Level 2 covering additional science fundamentals which basic includes heat load calculations, fan laws and pumps) and electricity.

Science Objectives and Content:	<u>Percent of Unit Mark (%)</u>
12 Review metals and alloys.	10%
13 Review hydrodynamics, hydrostatics and pneumatics.	10%
14 Review properties of water.	10%
15 Review simple machines.	10%
16 Review gas appliances, sequence of operation.	10%

Plumber

UNIT: D8 PRE-IP CODE REVIEW

Subunit: D8a Pre-IP Code Review

Level: Four

Duration: 25 hours

Theory: 25 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to instruct the apprentice in the learning and understanding of fire protection standpipe systems; hydronic heating, swimming pools and medical gas installation as well as having a general review of the previous levels.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sewers.	5%
2. Identify sanitary drainage system.	5%
3. Identify storm drainage.	5%
4. Identify special requirement drainage components.	5%
5. Identify indirect connections.	5%
6. Identify venting systems.	5%
7. Identify fixtures.	5%
8. Describe how to create layouts.	5%
9. Describe how to install water supply.	5%
10. Identify hot water supply.	5%
11. Identify valves.	5%
12. Describe how to conduct testing methods for sanitary drainage, storm drainage, (water, air, smoke, ball, and odour), and water piping, (water—hydrostatic and air), and stand pipe systems.	5%

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| 13. | Describe how to use builder's level. | 5% |
| 14. | Identify private sewage disposal systems. | 5% |
| 15. | Describe how to install rural water supply. | 5% |
| 16. | Describe how to conduct water treatment: explain how to perform tests on a rural water sample for hardness, pH, iron, taste and odour, turbidity, colour, and sediment. S/he should be able to explain how to select, install and maintain the proper components to ensure a sufficient supply of softened, iron free, mineral free, pH balanced potable water in a rural installation. | 5% |
| 17. | Identify swimming pool equipment. | 5% |
| 18. | Identify standpipe systems. | 5% |
| 19. | Describe how to Install standpipe systems. | 5% |
| 20. | Describe how to install hydronic heating. | 5% |

Plumber

UNIT: D9 PRE-IP TRADE SAFETY REVIEW

Subunit: D9a Pre-IP Trade Safety Review

Level: Four

Duration: 5 hours

Theory: 5 hours

Practical: 0 hours

Overview:

Plumbers require knowledge of safety equipment, its applications, maintenance and procedures for use, knowledge of safe work practices, and knowledge of regulatory requirements pertaining to safety. This unit of instruction is the program gateway to further learning about these topics.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify types of personal protective equipment (PPE) and clothing and describe their applications, limitations and procedures for use.	25%
2. Describe the procedures used to care for, maintain and store PPE.	25%
3. Identify hazards and describe safe work practises.	25%
a. Personal	
b. Workplace	
• Tag out/lockout,	
• Confined space	
• Trenches	
• Fire	
• Heights	
• Asbestos.	
• Environment	
4. Identify and describe workplace safety and health regulations and certification requirements.	25%
a. Federal: Material/Safety Data Sheets (M/SDS), - Workplace Hazardous Material	
b. Information System (WHMIS), - Transportation of Dangerous Goods (TDG)	
c. Provincial/territorial/municipal	

Plumber

**UNIT: D10 ELECTRICAL SCHEMATICS & TROUBLESHOOTING
HYDRONICS AND PLUMBING SYSTEMS**

**Subunit: D10a Electrical Schematics & Troubleshooting Hydronics &
Plumbing Systems**

Level: Four

Duration: 30 hours

Theory: 23 hours

Practical: 7 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with the basic knowledge and understanding of electrical schematics and troubleshooting, Hydronics and Plumbing systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify sources of information relevant to.	40%
a. Interpreting electrical schematics for pumps and related equipment	
b. Interpreting electrical schematics for plumbing systems	
c. Interpreting electrical schematics for hydronic systems	
2. Describe the considerations for determining.	40%
a. Troubleshooting electrical related issues for pumps and related equipment	
b. Troubleshooting electrical related issues for plumbing systems	
c. Troubleshooting electrical related issues for hydronic systems	
3. Demonstrate the procedures used to maintain and troubleshoot electrical related issues for pumps, plumbing systems and hydronic systems.	20%

Plumber

Unit: D11 GAS PIPING SYSTEMS

Subunit: D11a Gas Piping Systems

Level: Four

Duration: 30 hours

Theory: 30 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Plumber apprentice with the basic knowledge and understanding of gas piping systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with gas piping systems.	7%
2. Identify hazards and describe safe work practices pertaining to gas piping systems.	7%
3. Identify hazards and describe safe work practices pertaining to the handling, storage and transportation of gas cylinders.	7%
4. Describe the properties and characteristics of gases used in gas piping systems. a. Physical characteristics b. Composition c. Toxicity d. Specific gravity e. Heating value f. Flame temperature and speed g. Limits of flammability h. Ignition temperature i. Combustion process	7%
5. Identify types of gas piping systems and describe their characteristics and applications. a. Natural gas: liquefied, compressed b. Liquefied petroleum gas c. Petroleum d. Inert gas	7%
6. Interpret codes and regulations pertaining to gas piping systems: jurisdictional certification requirements.	7%

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| 7. Interpret information pertaining to gas piping systems found on drawings and specifications. | 7% |
| 8. Identify tools and equipment relating to gas piping systems and describe their applications and procedures for use. | 7% |
| 9. Identify gas piping system components and describe their purpose and operation. | 7% |
| 10. Identify the factors to consider for determining pipe sizing in gas piping systems. | 7% |
| 11. Describe the procedures used to install gas piping system components. | 7% |
| 12. Describe the procedures used to protect gas piping system components. | 7% |
| 13. Describe the procedures used to maintain and repair gas piping system components. | 8% |
| 14. Describe the procedures used to test and troubleshoot gas piping system components. | 8% |
