

Steamfitter-Pipefitter Level 3

Steamfitter-Pipefitter

Unit: C1 Low Pressure Steam Systems

Level: Three

Duration: 55 hours

Theory: 35 hours

Practical: 20 hours

Overview:

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

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Explain the properties of steam.	4%
2. Describe the use of steam tables. a. pressure b. temperature c. latent heat d. sensible heat e. total heat f. volume	4%
3. Define terminology associated with low pressure steam systems.	4%
4. Identify hazards and describe safe work practices pertaining to low pressure steam systems.	4%
5. Interpret codes and regulations pertaining to low pressure steam systems. a. American Society of Mechanical Engineers (ASME)	4%
6. Interpret information pertaining to low pressure steam systems found on drawings and specifications.	4%
7. Identify tools and equipment relating to low pressure steam systems and describe their applications and procedures for use.	4%
8. Explain the applications of low pressure steam systems.	4%

- a. heating
 - b. process
9. **Identify types of low pressure steam heating systems and describe their characteristics.** 4%
- a. mechanical return
 - b. gravity return
10. **Identify types of low pressure steam process systems and describe their characteristics.** 4%
- a. mechanical return
 - b. gravity return
11. **Describe the procedures used to grade piping in commercial sanitary drainage systems.** 4%
- a. Boilers: fire tube, water tube
 - b. boiler trim
 - c. piping
 - d. supports
 - e. connections
 - f. expansion joints
 - g. pumps
 - h. heat transfer equipment
 - i. steam traps: mechanical, thermostatic, thermodynamic
 - j. tanks
 - k. valves
 - l. water treatment equipment
12. **Identify types of low pressure steam system controls and describe their purpose and operation.** 4%
- a. low water cut-offs (LWCO)
 - b. operating pressure controls
 - c. high limit pressure controls
 - d. zone valves (motorized)
13. **Describe the procedures used to install steam tracing, their controls and components.** 4%
14. **Describe the procedures used to install low pressure steam systems, their controls and components.** 4%
15. **Describe the procedures used to maintain and repair low pressure steam systems, their controls and components.** 4%

16. Describe the procedures used to test and troubleshoot low pressure steam systems, their controls and components. 4%
17. Demonstrate the procedures used to install, maintain, repair, test and troubleshoot low pressure steam systems. 36%

Steamfitter-Pipefitter

Unit: C2 High Pressure Steam Systems

Level: Three

Duration: 79 hours

Theory: 49 hours

Practical: 30 hours

Overview:

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

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with high pressure steam systems.	5%
2. Identify hazards and describe safe work practices pertaining to high pressure steam systems.	5%
3. Interpret codes and regulations pertaining to high pressure steam systems. a. American Society of Mechanical Engineers (ASME)	5%
4. Interpret information pertaining to high pressure steam systems found on drawings and specifications.	5%
5. Identify tools and equipment relating to high pressure steam systems and Describe their applications and procedures for use.	5%
6. Explain the applications of high pressure steam systems. a. power generation b. process	5%
7. Explain the applications of high pressure steam systems. a. power generation b. process	5%
8. Identify high pressure steam system components and describe their purpose and operation. a. boilers: fire tube, water tube	6%

- 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
- 9. Identify types of high pressure steam system controls and describe their purpose and operation. 6%**
- a. low water cut-offs (LWCO)
 - b. operating pressure controls
 - c. high limit pressure controls
 - d. pressure reducing valves
- 10. Describe the procedures used to install high pressure steam and super-heated systems, their controls and components. 5%**
- 11. Describe the procedures used to maintain and repair high pressure steam and super-heated systems, their controls and components. 5%**
- 12. Describe the procedures used to test and troubleshoot high pressure steam and super-heated systems, their controls and components. 5%**
- 13. Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot high pressure steam systems. 38%**

Steamfitter-Pipefitter

Unit: C3 Condensate Return Systems

Level: Three

Duration: 37 hours

Theory: 30 hours

Practical: 7 hours

Overview:

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

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with condensate return systems.	10%
2. Identify hazards and describe safe work practices pertaining to condensate return systems.	10%
3. Interpret codes and regulations pertaining to condensate return systems. a. American Society of Mechanical Engineers (ASME)	10%
4. Interpret information pertaining to condensate return systems found on drawings and specifications.	10%
5. Identify types of condensate return systems and describe their characteristics and applications.	10%
6. Identify condensate return system components and describe their purpose and operation. a. piping b. traps c. tanks d. expansion joints e. pumps f. valves	10%
7. Describe the procedures used to install condensate return systems and components.	10%
8. Describe the procedures used to maintain and repair condensate return systems and components.	5%

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| 9. | Describe the procedures used to test and troubleshoot condensate return systems and components. | 5% |
| 10. | Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot condensate return systems. | 20% |

Steamfitter-Pipefitter

Unit: C4 Hydraulic Systems

Level: Three

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	4%

- d. valves
- e. accumulators
- f. piping
- g. strainers
- h. supports

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| 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% |

Steamfitter-Pipefitter

Unit: C5 Compressed Air Systems

Level: Three

Duration: 14 hours

Theory: 7 hours

Practical: 7 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:	<u>Percent of Unit Mark (%)</u>
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. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> a. instrument b. utility c. process d. make up/breathable 	4%
8. Identify compressed air system components and describe their purpose and operation. <ul style="list-style-type: none"> a. compressors 	4%

- b. piping
 - c. valves
 - d. controls
 - 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%**

Steamfitter-Pipefitter

Unit: C6 Medical Gas and Gas Piping Systems

Level: Three

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 medical gas and gas piping systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with medical gas systems and gas piping systems.	8%
2. Identify hazards and describe safe work practices pertaining to medical gas systems and gas piping systems pertaining to the handling, storage and transportation of gas cylinders.	8%
3. Interpret codes and regulations pertaining to medical gas systems. a. Diameter Index Safety System (DISS) b. pin indexing system	8%
4. Interpret information pertaining to medical gas systems found on drawings and specifications.	8%
5. Identify tools and equipment relating to medical gas systems and describe their applications and procedures for use.	8%
6. Identify types of medical gases and describe their characteristics. a. oxygen b. nitrogen c. nitrous oxide/anesthetic d. medical air e. vacuum f. physical characteristics g. composition h. toxicity i. specific gravity	8%

- j. heating value
 - k. flame temperature and speed
 - l. limits of flammability
 - m. ignition temperature
 - n. combustion process
 - o. natural gas liquefied
 - p. natural gas -compressed
 - q. liquefied petroleum gas
 - r. petroleum
- 7. Identify medical gas system and gas piping systems equipment, components and accessories and describe their applications and operation. 8%**
- a. vacuum pumps
 - b. medical air compressors
 - c. piping
 - d. valves
 - e. alarms
 - f. sensors
- 8. Identify the considerations for selecting components and accessories for medical gas systems and gas piping systems. 8%**
- 9. Describe the procedures used to install medical gas systems and gas piping systems and pipe sizing. 8%**
- 10. Describe the procedures used to protect medical gas systems and gas piping systems. 8%**
- 11. Describe the procedures used to maintain and repair medical gas systems and gas piping systems. 10%**
- 12. Describe the procedures used to test and troubleshoot medical gas systems and gas piping systems. 10%**

Steamfitter-Pipefitter

Unit: C7 Maths/Sciences III (includes heat load calculations, fan laws, and pumps)

Level: Three

Duration: 40 hours

Theory: 40 hours

Practical: 00 hours

Overview:

Steamfitters-Pipefitters require a good, practical grasp of mathematics and sciences systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe by reviewing level one contents relating to elevations and grades.	8%
2. Describe rolling offsets.	8%
3. Describe jumper offsets.	8%
4. Describe special case of 45° offset..	8%
5. Describe water pressure.	8%
a. head	
b. force	
6. Describe air pressure and air chambers.	8%
7. Describe ratio of pipe capacities.	8%
8. Describe ratio and proportion.	8%
9. Describe conversion factors.	8%
10. Describe by reviewing any problem math content.	8%
11. Describe basic electricity.	8%
a. electron theory	
b. Ohm's Law	
c. basic series circuits	

- d. parallel circuit
- e. millivoltage
- f. 24 volt circuit
- g. 110 volt circuit
- h. open and closed circuits (controls)
- i. relay circuit
- j. voltage drops in circuit

12. Describe electrical devices.

8%

- a. thermopile and thermocouple
- b. transformer
- c. gas valves
- d. thermostats
- e. safety controls
- f. connectors and connections
- g. wire sizes and types
- h. meters
- i. Code requirements
- j. motors

13. Describe gas appliances, sequence of operation.

4%

- a. basic wiring systems
- b. circuit wiring systems
- c. wiring diagrams of the appliances
- d. troubleshooting controls and circuits
- e. electronic ignition systems

Steamfitters-Pipefitters

Unit: C8 Refrigeration Systems

Level: Three

Duration: 15 hours

Theory: 15 hours

Practical: 00 hours

Overview:

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

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
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	10%

refrigeration systems.

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

Steamfitter-Pipefitter

Unit: C9 Gas Code II

Level: Three

Duration: 25 hours

Theory: 20 hours

Practical: 5 hours

Overview:

Steamfitters-Pipefitters require a good, practical grasp of intermediate level gas code content.

Objectives and Content:

**Percent of
Unit Mark (%)**

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|---|-----|
| 1. Describe B 149.1 section 8. | 80% |
| a. air supply | |
| b. gas venting | |
| 2. Demonstrate air supply and gas venting as applied. | 20% |

Steamfitter-Pipefitter

Unit: C10 Electrical II

Level: Three

Duration: 30 hours

Theory: 20 hours

Practical: 10 hours

Overview:

Steamfitters-Pipefitters require a good, practical grasp of intermediate level electrical content. This unit of instruction 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 and build on what was previously taken in level 1 Steamfitter/Pipefitter technical training.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe intermediate molecular electron theory as related to conductors, insulators, semi-conductors, unstable, and stable elements.	.9%
2. Define intermediate terminology, definitions, formula symbols, measurement symbols of the 4 properties of electricity of resistance, current, voltage, and power.	.9%
3. Define intermediate terminology associated with electricity as related to the trade.	.2%
4. Defining and calculating intermediate conversions of power such as watts, kilowatts, kilowatt hours, horsepower, btu's.	2.5%
5. Identify the 4 parts to a circuit and identify intermediate circuit drawing symbols as well as open, closed circuit controls.	.9%
6. Explain intermediate Ohm's law and Power law - describe their applications and associated calculations.	.9%
7. Explain and identify basic ways in which electricity is generated and how we obtain our main source of electricity from MB Hydro power stations to power lines to our distribution panels.	3%
8. Identify intermediate 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 intermediate 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: <ul style="list-style-type: none"> a. polarity 	6.7%

- b. analog
 - c. digital
 - d. voltmeter
 - e. ammeter
 - f. clamp-on ammeter
 - g. ohmmeter
 - h. megohmmeter,
 - i. wattmeter
- 10. Describe basic electromagnetism and Inductance (including the operation of coils), rotating magnetic fields, generator applications, stored energy (Lenz's Law), motor principles.** 6.7%
- 11. Describe basic 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 & 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. Basic 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 intermediate types of electrical circuits and describe their characteristics, operation and applications.** 5%
- a. series
 - b. parallel
 - c. series-parallel
- 14. Interpret intermediate 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 basic function of motors and Identify their parts.** 6.7%
- a. DC motors

- b. AC motors
 - c. ECM motors
- 16. Canadian Electrical code basic introduction. 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. Basic troubleshooting and critical thinking strategies. 6.7%**
- 18. Working with intermediate shop projects and hands on electrical meter usage, wiring, analyzing, and troubleshooting circuits. 33%**
