SKILLED TRADES BC

PROGRAM OUTLINE

Sprinkler Fitter

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SPRINKLER FITTER
HARMONIZED PROGRAM OUTLINE

APPROVED BY INDUSTRY

NOVEMBER 2017

BASED ON

RSOS 2017

(DRAFT)

Developed by
SkilledTradesBC
Province of British Columbia

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Section 1

INTRODUCTION

Sprinkler Fitter

Foreword

The revised Sprinkler Fitter Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on the new Sprinkler Fitter Red Seal Occupational Standard (2017) and British Columbia industry and instructor subject matter experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

The Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

Each competency is to be evaluated through the use of written examination in which the learner must achieve a minimum of 70% in order to receive a passing grade for that competency. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the learning tasks listed in the related competencies.

Achievement Criteria are included for those competencies that require a practical component. The intent of including Achievement Criteria in the program outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measureable and that they reflect the skills spelled out in the competency as those required of a competent journeyperson. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the level of expectation of success.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

SAFETY ADVISORY

Be advised that references to the WorkSafeBC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: http://www.worksafebc.com). Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

Acknowledgements

The Occupational Analysis Chart was prepared with the advice and direction of instructor and industry subject matter experts convened by SkilledTradesBC. Members include:

- Dan Bowers, Pacific Vocational College
- Jamie McPherson, Camosun College
- Jim Gilley, The Gisbourne Group
- Shaun Budden, National Hydronics

Industry and training provider subject matter experts retained to assist in the development of Program Outline content:

- Dan Bowers, Pacific Vocational College
- Jamie McKenzie, Canadian Automatic Sprinkler Association
- Jamie McPherson, Camosun College
- Jim Gilley, The Gisborne Group
- Shaun Budden, National Hydronics

Facilitators:

- Angela Caughy

SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Sprinkler Fitter occupation.

How to Use this Document

This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Program Credentialing Model	Communicate program length and structure, and all pathways to completion	Understand the length and structure of the program	Understand the length and structure of the program, and pathway to completion	Understand challenger pathway to Certificate of Qualification
OAC	Communicate the competencies that industry has defined as representing the scope of the occupation	Understand the competencies that an apprentice is expected to demonstrate in order to achieve certification	View the competencies they will achieve as a result of program completion	Understand the competencies they must demonstrate in order to challenge the program
Training Topics and Suggested Time Allocation	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Understand the relative weightings of various competencies of the occupation on which assessment is based
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measureable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels
Training Provider Standards	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own	Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors	Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Appendix – Glossary of Acronyms			Defines program specific acronyms	

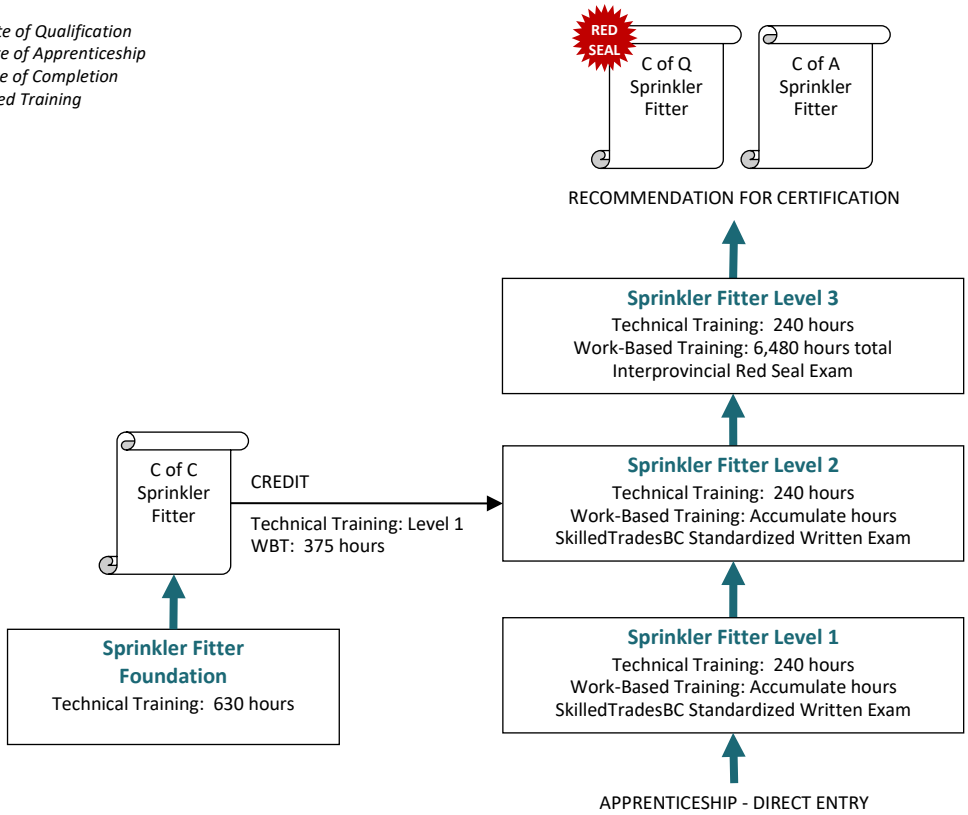
Section 2

PROGRAM OVERVIEW

Sprinkler Fitter

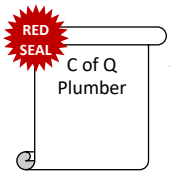
Program Credentialing Model

C of Q = Certificate of Qualification
C of A = Certificate of Apprenticeship
C of C = Certificate of Completion
WBT = Work-Based Training

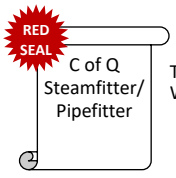


CROSS-PROGRAM CREDITS

Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of this program



Technical Training: Level 1
Work-Based Training: 3,600 hours



Technical Training: Level 1
Work-Based Training: 3,600 hours

Occupational Analysis Chart

SPRINKLER FITTER

Occupation Description: Sprinkler Fitters layout, install, repair, modify, inspect, test and maintain fire protection systems in a variety of buildings and settings. They work on fire protection systems such as wet, dry, water mist, pre-action, foam, deluge, standpipe, clean agent, carbon dioxide, hybrid, antifreeze, and wet and dry chemical fire suppression system. Their duties include reading and interpreting engineered drawings, installing hangers and clamps to support the piping system, preparing the pipe, joining pipe using a variety of methods and installing associated equipment.

PERFORM SAFETY RELATED FUNCTIONS A	Maintains Safe Work Environment A1	Use Personal Protective Equipment (PPE) and Safety Equipment A2	Perform Lock-Out and Tag-Out Procedures A3	Use Fire Extinguishers A4	
USE TOOLS AND EQUIPMENT B	Use Common Tools and Equipment B1	Use Access Equipment B2	Use Rigging, Hoisting, Lifting and Positioning Equipment B3	Use Soldering and Brazing Equipment B4	
PERFORM ROUTINE TRADE ACTIVITIES C	Use Mathematics and Science C1	Interpret Drawings and Specifications C2	Use Codes, Regulations and Standards C3	Use Manufacturer's Documentation C4	Perform Piping System Layout C5
INSTALL PIPING AND COMPONENTS D	Prepare Pipe and Tubing D1	Join Tube, Tubing and Pipe D2	Install Pipe and Tubing D3	Install Valves D4	Install Fittings D5	Install Piping Components D6

HARMONIZED PROGRAM OUTLINE
Program Overview

INSTALL WATER-BASED SYSTEMS **E**	Install Wet Pipe Systems E1	Install Dry Pipe Systems E2	Install Antifreeze Systems E3	Install Preaction/Deluge Systems E4	Install Standpipe Systems E5	Install Foam Systems E6
	1 2	1 2	1 2	1 2	2	3
	Install Water Mist and Hybrid Systems E7					
	3					
USE COMMUNICATION TECHNIQUES **F**	Use Communication Techniques F1	Use Mentoring Techniques F2				
	1	3				
INSTALL WATER SUPPLY **G**	Install Underground Water Supply G1	Install Fire Department Connections G2	Install Fire Pump Units G3	Install Private Water Supply Systems G4	Install and Test Cross Connection Control Components G5	
	2	2	3	3	2	
INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES **H**	Install Detection Systems and Devices H1	Install Alarm-Initiating Devices H2	Install Dry and Wet Chemical, Clean Agent and Carbon Dioxide Systems H3	Install Portable Extinguishers H4	Install Spark Detection Systems H5	
	2 3	2	3	3	3	
COMMISSION AND MAINTAIN SYSTEMS **I**	Commission Systems I1	Inspect and Test Fire Protection Systems I2	Maintain and Repair Fire Protection Systems I3			
	2 3	3	3			

Training Topics and Suggested Time Allocation: Level 1

SPRINKLER FITTER – LEVEL 1

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**PERFORM SAFETY RELATED FUNCTIONS**	**5%**	**100%**	**0%**	**100%**
A1	Maintain Safe Work Environment		✓		
A2	Use Personal Protective Equipment (PPE) and Safety Equipment		✓		
A3	Perform Lock-Out and Tag-Out Procedures		✓		
A4	Use Fire Extinguishers		✓		
Line B	**USE TOOLS AND EQUIPMENT**	**15%**	**50%**	**50%**	**100%**
B1	Use Common Tools and Equipment		✓	✓	
B2	Use Access Equipment		✓		
B3	Use Rigging, Hoisting, Lifting and Positioning Equipment		✓	✓	
B4	Use Soldering and Brazing Equipment		✓	✓	
Line C	**PERFORM ROUTINE TRADE ACTIVITIES**	**46%**	**75%**	**25%**	**100%**
C1	Use Mathematics and Science		✓		
C2	Interpret Drawings and Specifications		✓	✓	
C3	Use Codes, Regulations and Standards		✓		
C4	Use Manufacturer's Documentation		✓		
C5	Perform Piping System Layout		✓		
Line D	**INSTALL PIPING AND COMPONENTS**	**27.5%**	**60%**	**40%**	**100%**
D1	Prepare Pipe and Tubing		✓	✓	
D2	Join Tube, Tubing and Pipe		✓	✓	
D3	Install Pipe and Tubing		✓	✓	
D4	Install Valves		✓	✓	
D5	Install Fittings		✓	✓	
D6	Install Piping Components		✓		
Line E	**INSTALL WATER-BASED SYSTEMS**	**6%**	**100%**	**0%**	**100%**
E1	Install Wet Pipe Systems		✓		
E2	Install Dry Pipe Systems		✓		
E3	Install Antifreeze Systems		✓		
E4	Install Preaction/Deluge Systems		✓		
Line F	**USE COMMUNICATION TECHNIQUES**	**0.5%**	**100%**	**0%**	**100%**
F1	Use Communication Techniques		✓		
	Total Percentage for Sprinkler Fitter Level 1	**100%**			

Training Topics and Suggested Time Allocation: Level 2

SPRINKLER FITTER – LEVEL 2

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line C	**PERFORM ROUTINE TRADE ACTIVITIES**	**32.5%**	**80%**	**20%**	**100%**
C1	Use Mathematics and Science		✓		
C2	Interpret Drawings and Specifications		✓	✓	
C3	Use Codes, Regulations and Standards		✓		
C4	Use Manufacturer's Documentation		✓		
C5	Perform Piping System Layout		✓	✓	
Line D	**INSTALL PIPING AND COMPONENTS**	**12.5%**	**100%**	**0%**	**100%**
D3	Install Pipe and Tubing		✓		
D4	Install Valves		✓		
D6	Install Piping Components		✓		
Line E	**INSTALL WATER-BASED SYSTEMS**	**21%**	**50%**	**50%**	**100%**
E1	Install Wet Pipe Systems		✓	✓	
E2	Install Dry Pipe Systems		✓	✓	
E3	Install Antifreeze Systems		✓		
E4	Install Preaction/Deluge Systems		✓		
E5	Install Standpipe Systems		✓		
Line G	**INSTALL WATER SUPPLY**	**22.5%**	**60%**	**40%**	**100%**
G1	Install Underground Water Supply		✓		
G2	Install Fire Department Connections		✓		
G5	Install and Test Cross Connection Control Components		✓	✓	
Line H	**INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES**	**9%**	**60%**	**40%**	**100%**
H1	Install Detection Systems and Devices		✓		
H2	Install Alarm Initiating Devices		✓	✓	
Line I	**COMMISSION AND MAINTAIN SYSTEMS**	**2.5%**	**100%**	**0%**	**100%**
I1	Commission Systems		✓		
	Total Percentage for Sprinkler Fitter Level 2	**100%**			

Training Topics and Suggested Time Allocation: Level 3

SPRINKLER FITTER – LEVEL 3

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line C	**PERFORM ROUTINE TRADE ACTIVITIES**	**35%**	**50%**	**50%**	**100%**
C2	Interpret Drawings and Specifications		✓	✓	
C3	Use Codes, Regulations and Standards		✓		
C5	Perform Piping System Layout		✓	✓	
Line E	**INSTALL WATER-BASED SYSTEMS**	**10%**	**100%**	**0%**	**100%**
E6	Install Foam Systems		✓		
E7	Install Water Mist and Hybrid Systems		✓		
Line F	**USE COMMUNICATION TECHNIQUES**	**0.5%**	**100%**	**0%**	**100%**
F2	Use Mentoring Techniques		✓		
Line G	**INSTALL WATER SUPPLY**	**17%**	**100%**	**0%**	**100%**
G3	Install Fire Pump Units		✓		
G4	Install Private Water Supply Systems		✓		
Line H	**INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES**	**7.5%**	**100%**	**0%**	**100%**
H1	Install Detection Systems and Devices		✓		
H3	Install Dry and Wet Chemical, Clean Agent and Carbon Dioxide Systems		✓		
H4	Install Portable Fire Extinguishers		✓		
H5	Install Spark Detection Systems		✓		
Line I	**COMMISSION AND MAINTAIN SYSTEMS**	**30%**	**90%**	**10%**	**100%**
I1	Commission Systems		✓		
I2	Inspect and Test Fire Protection Systems		✓	✓	
I3	Maintain and Repair Fire Protection Systems		✓		
	Total Percentage for Sprinkler Fitter Level 3	**100%**			

Section 3

PROGRAM CONTENT

Sprinkler Fitter

Level 1

Sprinkler Fitter

Line (GAC): A PERFORM SAFETY RELATED FUNCTIONS

Competency: A1 Maintain Safe Work Environment

Objectives

To be competent in this area, the individual must be able to:

- Manage workplace hazards.
- Use WHMIS.

LEARNING TASKS

1. Identify workplace hazards

CONTENT

- Short term hazards
  - Confined space
  - Elevations
    - Ladders
    - Work platforms
  - Electrical
  - Compressed gas
  - Explosive material
    - Gas
    - Dust
  - Working condition temperatures
    - Extreme high
    - Extreme low
  - Weather
    - Lightning
    - Precipitation
  - Air quality
    - Carbon monoxide limits
    - Dust
    - Asbestos
  - Excavations
  - Working around heavy equipment
  - Control zones
    - Limited access areas
    - Fall restraint
  - Sharp objects
  - Lifting
    - Correct lifting posture
    - Discretion of lifter
  - Personal apparel
    - Clothing
    - Hair and beards
    - Jewelry

LEARNING TASKS	CONTENT
	○ Safe attitude – Housekeeping – Horseplay – Respect for others' safety – Constant awareness of surroundings • Long term hazards ○ Respiratory disease ○ Repetitive strain injuries ○ Excessive noise ○ Chemical exposure • Stressed cables ○ Rigging ○ Post-tension
2. Describe safety hazards when working at elevations	• Floor openings • Wind • Access equipment
3. Describe safety precautions when working at elevations	• Fall restraint ○ Guard rails ○ Safety lines • Fall arrest • Proper clothes (PPE)
4. Manage workplace hazards	• Workplace Hazard Materials Identification System (WHMIS) ○ Purpose ○ Material Safety Data Sheets (MSDS) ○ Labels ○ Symbols ○ Regulations • Transportation of Dangerous Goods (TDG) • Occupational Health and Safety (OHS) regulation ○ Rights and responsibilities ○ Inspections ○ General conditions • WorkSafeBC standards • Chemical hazard response ○ Eyewash facilities ○ Emergency shower

LEARNING TASKS	CONTENT

	• Evacuation plan
	  ○ Marshalling/mustering areas
	  ○ Emergency exits
	  ○ Emergency contact/phone numbers

5. Describe how site specific safety policies are established	• Standards, acts and regulations
	• Hazard assessment
	  ○ Safety policy
	  ○ Site conditions
	• Types of meetings
	  ○ Tool box
	  ○ Safety committee

Achievement Criteria (Workplace)

Performance	The learner is aware of WHMIS and that it is a required certification.
Conditions	To be assessed in the workplace.
Criteria	Tasks must be performed within specifications and time frames acceptable to industry.

Line (GAC): A PERFORM SAFETY RELATED FUNCTIONS

Competency: A2 Use Personal Protective Equipment (PPE) and Safety Equipment

Objectives

To be competent in this area, the individual must be able to:

- Use and maintain Personal Protective Equipment (PPE) and safety equipment.

LEARNING TASKS	CONTENT

1. Describe Personal Protective Equipment (PPE)	• Safety footwear
	• Eye protection
	• Ear protection
	• Head protection
	• Respiratory protection
	  ○ Positive pressure
	  ○ Negative pressure
	• Clothing
	  ○ High visibility workwear
	  ○ Sun protection factor (SPF)
	  ○ Gloves
	  ○ Fall protection

2. Describe safety equipment	• Types
	  ○ Fire extinguishers
	  ○ First-aid
	  ○ Ventilation
	  ○ Protective barriers
	• Standards, acts, regulations and manufacturer's documentation
	  ○ Storage
	  ○ Limitations
	  ○ Procedures
	  ○ Maintenance
	  ○ Inspection
	  ○ Selection

3. Use Personal Protective Equipment (PPE)	• Purpose
	• Training requirements
	  ○ WorkSafeBC requirements
	  ○ Job site requirements
	• Standards, acts, regulations and manufacturer's documentation
	  ○ Storage
	  ○ Limitations
	  ○ Procedures

LEARNING TASKS	CONTENT
	○ Maintenance ○ Inspection ○ Selection

Line (GAC): A PERFORM SAFETY RELATED FUNCTIONS

Competency: A3 Perform Lock-Out and Tag-Out Procedures

Objectives

To be competent in this area, the individual must be able to:

- Identify and use lock-out and tag-out procedures.

LEARNING TASKS	CONTENT
1. Identify energy sources	• Electricity • Pressure • Kinetic

2. Describe lock-out and tag-out	• Understanding of system operation
	• Components requiring lock-out
	• Situations where lock-out is required
	• Lock-out equipment
	  ○ Locks
	  ○ Tags
	  ○ Identification requirements
	  ○ Chains
	  ○ Support blocks
	  ○ Blind flanges
	  – Spades
	  – Spectacle blinds

3. Use lock-out and tag-out procedures	• Procedures
	• Zero energy state
	  ○ Disconnect
	  ○ Depressurize
	  ○ Isolate
	• Lock-out
	• Tag-out
	• Test

Line (GAC): A PERFORM SAFETY RELATED FUNCTIONS

Competency: A4 Use Fire Extinguishers

Objectives

To be competent in this area, the individual must be able to:

- Identify classes of fires.
- Select fire extinguishers for class of fire and relevant condition.

LEARNING TASKS	CONTENT
1. Describe the conditions necessary to support a fire	• Oxygen • Fuel • Heat • Chemical chain reaction
2. Describe the classes of fires according to the materials being burned	• Class A • Class B • Class C • Class D • Class K • Symbols and colours of all classes

3. Apply preventative fire safety precautions	• Hot work permit (site specific)
	• Handling and storage of flammable materials
	• Symbols
	• Fuels
	  ○ Diesel
	  ○ Gasoline
	  ○ Propane
	  ○ Natural Gas
	• Ventilation, including purging
	• Lubricants
	• Oily rags
	• Combustible metals
	• Aerosols
	• Fire extinguisher
	  ○ Fill level
	  ○ Inspection tag
	  – Expiry date

4. Describe the considerations and steps to be taken prior to fighting a fire	• Warning others and fire department • Personal method of egress • Determine class of fire

LEARNING TASKS	CONTENT

5. Describe the procedure for using a fire extinguisher	• P.A.S.S.
	  ○ Pull
	  ○ Aim
	  ○ Squeeze
	  ○ Sweep

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B1 Use Common Tools and Equipment

Objectives

To be competent in this area, the individual must be able to:

- Use hand, portable and stationary power tools.
- Use measuring and leveling equipment.
- Describe electrical testing equipment.
- Inspect and maintain tools and equipment.

LEARNING TASKS

1. Describe hand tools

CONTENT

- Wrenches
- Pliers
- Files
- Screwdrivers
- Cutting tools
  - Saws
  - Snips
  - Gasket cutters
  - Pipe/tube cutters
  - Utility knife
- Vise
- Measuring and marking tools
  - Contour marker
  - Centre finder
  - Refractometer
  - Hydrometer
  - Circumference tape/pipe diameter tape
- Squaring tools
- Bracing and securing tools
- Hammering tools
- Leveling tools
  - Spirit levels (bubble)
  - Builder's level
  - Laser levels
  - Plumb bob
- Chiseling tools
- Threading tools
- Flaring and swaging tools
- Tubing benders
- Expanding and crimping tools

LEARNING TASKS	CONTENT

2. Describe portable power tools	• Types
	  ○ Electric
	  ○ Pneumatic
	• Cutting tools
	• Grinding and abrasive tools
	• Threading tools
	  ○ Nipple chuck
	  ○ Thread gauge
	  ○ Reamer
	• Drilling, boring and coring tools
	• Grooving tools
	• Specialty tools
	  ○ Flushing machine
	  ○ Fusion tools
	  ○ Pressing tool (Pro press™)
	  ○ Extruded T (T-Drill™)
	• Accessories

3. Describe stationary power tools	• Cutting tools • Grinding and abrasive tools • Threading tools • Drilling and boring tools • Grooving tools • Specialty tools • Accessories

4. Describe pressure measuring tools	• Mechanical gauges
	  ○ Analog
	  ○ Digital
	  ○ Standard
	  ○ Compound
	  ○ Differential

5. Describe electrical testing equipment	• Multi-meter • Volt meter • Ammeter • Ohmmeter
6. Use hand tools and equipment	• Applications • Procedures • Safe work practices • Adjustment • Inspection

LEARNING TASKS	CONTENT
7. Use leveling equipment to establish elevations	• Maintenance • Storage • Grade and pitch calculations • Procedures • Manufacturers' documentation • Inspection • Adjustment • Maintenance • Storage

8. Use circumference tape/diameter tape to determine pipe groove compatibility	• Measurements
	  ○ Flare
	  ○ Groove
	  ○ Outside diameter
	• Manufacturer's specifications

Achievement Criteria 1

Performance — The learner will be able to establish a minimum 5 sights.

Conditions — To be assessed during technical training.
The learner will be given:

- Sights
- Specifications
- Leveling equipment

Criteria — The learner will be evaluated on:

- Accuracy

Achievement Criteria 2

Performance — The learner will be able to determine the compatibility of grooves taken on 10 sample grooves.

Conditions — To be assessed during technical training.
The learner will be given:

- Tools and equipment
- Groove samples
- Groove specifications

Criteria — The learner will be evaluated on:

- Accuracy of measurements
- Proper selection of compatible grooves
- Completion of documentation report

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B2 Use Access Equipment

Objectives

To be competent in this area, the individual must be able to:

- Select and use ladders and elevated platforms.

LEARNING TASKS	CONTENT

1. Describe ladders and elevated platforms	• Types
	  ○ Ladders
	  ○ Platforms
	  ○ Scaffold
	  ○ Aerial Work Platform (AWP)
	• Applications
	• Safe work practices
	  ○ Fall arrest equipment
	  ○ Fall restraint equipment
	  ○ Hazard recognition
	• Standards, acts and regulations
	• Site certification requirements
	  ○ Equipment certifications
	  ○ Employer responsibilities

2. Use ladders and elevated platforms	• Selection • Operating procedures • Limitations • Securing • Inspection • Maintenance • Storage

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B3 Use Rigging, Hoisting, Lifting and Positioning Equipment

Objectives

To be competent in this area, the individual must be able to:

- Use hoisting, lifting and rigging equipment.

LEARNING TASKS	CONTENT

1. Describe lifting and hoisting	• Principles
	  ○ Mechanical advantage
	  ○ Balance points
	  ○ Safety
	  ○ Estimation of weights
	  ○ Equipment capacities
	  ○ Equipment selection
	  ○ Lifting location
	  ○ Operating procedures
	  ○ Communication/hand signals
	  ○ Securing of loads
	• Certification requirements
	• Lift plan

2. Describe lifting and hoisting equipment	• Boom trucks • Chain falls • Come-alongs • Cranes • Grip hoist®/Tirfor®/turfer • Loaders • Tuggers
3. Describe rigging equipment	• Chains • Shackles • Slings/chokes • Snatch blocks • Softeners • Spreader bars • Tag lines • Turnbuckles
4. Describe lifting and hoisting communication	• Hand signals • Audible signals • Communication with the operator • Communication with others

LEARNING TASKS	CONTENT

5. Select slings	• Load
	  ○ Load factor labels
	• Application
	  ○ Sling angles
	  ○ Sling lengths

6. Tie knots, bends and hitches	• Types
	  ○ Bowline
	  ○ Bowline on a bight
	  ○ Cat's paw
	  ○ Clove hitch
	  ○ Figure eight
	  ○ Half hitch
	  ○ Reef knot
	  ○ Sheet bend
	  – Single
	  – Double
	  ○ Timber hitch
	  ○ Trucker's hitch
	• Purposes
	• Limitations

7. Use hoisting, lifting and rigging equipment	• Safe work practices
	• Working load limit (WLL)
	• Lift plan
	• Communication/hand signals
	• Securing of loads
	  ○ Pre lift
	  ○ Post lift
	• Inspection
	• Maintenance
	• Storage
	• Remove from service

Achievement Criteria

Performance — The learner will be able to:
- Tie knots based on application.

Conditions — To be assessed during technical training.
The learner will be given:
- Various types of rope.

Criteria — The learner will be evaluated on:
- Accuracy

- Technique
- Application

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B4 Use Soldering and Brazing Equipment

Objectives

To be competent in this area, the individual must be able to:

- Use air-fuel and oxy-fuel equipment to braze, solder and cut.

LEARNING TASKS	CONTENT

1. Describe the brazing process	• Principles
	• Applications
	• Filler alloys
	• Equipment
	• Safety requirements
	  ○ Fire protection equipment
	  ○ Ventilation

2. Describe the procedures for braze welding	• Joint preparation and design • Flux selection • Flame for brazing • Purging
3. Describe air-fuel and oxy-fuel equipment	• Cylinders • Regulators • Gauges • Flashback arrestors • Torches

4. Use air-fuel and oxy-fuel equipment to braze and solder	• Safe work practices
	• Flammable material recognition
	• Applications
	• Procedures
	  ○ Setup
	  ○ Take down
	  ○ Tip selection
	  ○ Alloy selection
	  ○ Flux selection
	  ○ Flux removal
	• Inspection
	• Maintenance
	• Storage

Achievement Criteria

Performance	The learner will be able to braze and solder.
Conditions	To be assessed during technical training. The learner will be given: • Materials • Tools and equipment • Specifications/drawings
Criteria	The learner will be evaluated on: • Safe work practices • Setup/shut down • Technique • Accuracy • Penetration • Appearance • Pressure test • Bend test

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C1 Use Mathematics and Science

Objectives

To be competent in this area, the individual must be able to calculate:

- Pressure
- Force
- Offsets
- Ohm's law
- Linear expansion
- Elevation and grade
- Specific weight
- Density
- Area
- Volume
- Capacity
- Heat transfer
- Mass
- Fitting allowances
- Mechanical advantage

LEARNING TASKS	CONTENT
1. Apply calculator functions to trade related equations	• Whole numbers • Fractions • Decimals • Percentages
2. Use formulas to calculate lineal measurements	• Perimeter • Circumference
3. Use formulas to calculate area	• Cross-sectional area of pipe
4. Use formulas to calculate volumes	• Cylinders • Rectangular tanks
5. Use formulas to calculate capacity	• Imperial gallons • US gallons • Litres
6. Transpose formulas	• Processes

7. Perform conversions	• Length
	• Volume
	• Capacity
	• Area
	• Mass
	• Weight
	• Temperature
	  ○ Fahrenheit
	  ○ Centigrade
	  ○ Kelvin
	  ○ Rankine
	• Pressure
	  ○ Absolute
	  ○ Gauge

8. Calculate piping measurements	• Terms
	  ○ Thread allowance
	  ○ Fitting allowance
	  ○ End to end
	  ○ End to centre
	  ○ Centre to centre
	  ○ Face to face
	  ○ End to back
	  ○ Back to back
	  ○ Socket depth
	• Calculations
	• Grades
	• Elevations
	• Benchmarks

9. Use the Pythagorean theorem of right angles	• Hypotenuse • Side opposite • Side adjacent
10. Calculate offsets using the applicable trigonometric function	• Calculator methods • Table-based methods
11. Calculate the required measurements for a parallel piping offset	• Unequal spread • Equal spread • Rolling • Jumper

12. Describe the properties of matter	• Substances
	  ○ Elements
	  ○ Compounds
	  ○ Mixtures
	• Adhesion
	• Cohesion
	• Conductivity
	• Density
	• Ductility
	• Elasticity
	• Malleability
	• Tensile strength
	• Heat properties
	  ○ BTUs
	  ○ Specific Heat
	  ○ Kilowatts

13. Use Pascal's theory of pressure and force	• Pressure

		○ Pounds per square inch (psig) ○ Pascal (Pa) ○ KiloPascal (kPa) ○ Inches of water column (in WC) ○ Inches of mercury (in Hg) ○ Bar • Total Force ○ Pounds ○ Newtons
14.	Use Archimedes' principles of displacement and floatation	• Specific weight/gravity • Buoyancy
15.	Define mechanical advantage as it relates to fluid power	• Hydraulics • Hydrostatics
16.	Describe factors that affect fluid flow in a piping system	• Viscosity • Laminar flow • Turbulent flow • Velocity • Piping material • Fittings
17.	Describe factors that affect gas volumes and pressures	• Boyle's Law • Charles Law 1 & 2 (Gay-Lussac's Law) • Combined Gas Law • Bernoulli's principle
18.	Perform gas law calculations	• Boyle's Law • Charles Law 1 & 2 (Gay-Lussac's Law) • Combined Gas Law • Temperature ○ Kelvin ○ Rankine • Pressures ○ Absolute ○ Gauge
19.	Calculate the expansion and contraction of various piping materials due to heating and cooling	• Coefficient of thermal expansion ○ Ferrous ○ Non-ferrous ○ Thermoplastic
20.	Define methods of heat transfer	• Conduction • Convection • Radiation
21.	Perform heat load calculations	• Sensible

- Latent
- Specific heat

22. Describe the fundamentals of electricity

- Basic principles
  - Atomic theory
  - Electron flow
  - Conductors - insulators
  - Kinds of electricity
    - AC current
    - DC current
    - Static electricity
  - Cathodic protection
    - Anode
    - Cathode
- Properties of wire
  - Resistance
  - Calculating resistance
- Electrical sources
  - AC
  - DC

23. Describe electrical circuits

- Parts of a circuit
  - Source
  - Switch
    - Relays
    - SPST
    - SPDT
    - DPST
    - DPDT
  - Load
  - End of line resistors
  - Relays
- DC circuits and measurements
  - Voltage
  - Amperage
  - Resistance
  - Closed and opened
- AC circuits and measurements
  - Voltage
  - Amperage
  - Resistance
  - Closed and opened
- Fundamentals of magnetism
  - Magnetic fields
  - Coils

24. Use laws and formulas	• Ohm's Law

25. Describe single phase power characteristics	• Circuit protection
	  ○ Fuses
	  ○ Circuit breakers

26. Identify transformers	• Type of transformers
	  ○ Step-up
	  ○ Step-down
	• Primary winding
	• Secondary winding

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C2 Interpret Drawings and Specifications

Objectives

To be competent in this area, the individual must be able to:

- Interpret information found on a set of drawings.
- Use drafting symbols, lettering and line conventions.
- Convert between orthographic and isometric projections.
- Create an isometric drawing of a basic orthographic piping arrangement.

LEARNING TASKS	CONTENT

1. Describe drafting tools and materials	• Tools
	  ○ Compasses
	  ○ Dividers
	  ○ Drawing boards
	  ○ Splines
	  ○ French curves
	  ○ Protractors
	  ○ Scale rulers
	  ○ Triangles
	  ○ T-squares
	• Erasers and shields
	• Pencils
	• Templates

2. Use scale rulers	• Dimensions
	  ○ Imperial
	  ○ Metric

3. Describe piping symbols	• Fittings • Valves • Piping • Hangers

4. Describe characteristics of drafting lines and lettering	• Lines
	  ○ Border
	  ○ Center
	  ○ Dimension
	  ○ Extension
	  ○ Hidden
	  ○ Object
	  ○ Phantom
	  ○ Leader
	• Lettering

LEARNING TASKS	CONTENT

5. Describe types of drawings	• Architectural
	• Structural
	• Mechanical
	• Shop
	• Utility
	• Site plan
	• Specification sheets
	• General arrangement (GA)
	• Parts
	  ○ Details
	  ○ Title block
	  ○ Schedules
	  ○ Legends

6. Describe drawing projections	• Types
	  ○ Isometric
	  ○ Orthographic
	  ○ Oblique
	• Views
	  ○ Elevation
	  ○ Section
	  ○ Plan

7. Use drawing projections	• Isometric
	• Orthographic
	• Conversion
	  ○ Orthographic to isometric
	  ○ Isometric to orthographic

8. Create an isometric drawing of a basic piping arrangement	• Lettering • Line type • Relevant information • Detail required • Dimensioning

Achievement Criteria

Performance — The learner will be able to create an isometric drawing of a basic piping arrangement.

Conditions — To be assessed during technical training.
The learner will be given:
- T-squares
- Orthographic drawing

Criteria — The learner will be evaluated on:
- Accuracy
- Neatness

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C3 Use Codes, Regulations and Standards

Objectives

To be competent in this area, the individual must be able to:

- Identify codes, standards and organizations.
- Describe the application of codes and standards.

LEARNING TASKS	CONTENT

1. Identify codes, standards and organizations	• American National Standards Institute (ANSI)
	• American Society of Mechanical Engineers (ASME)
	• American Society of Testing and Materials (ASTM)
	• American Water Works Association (AWWA)
	• Canadian Standards Association (CSA)
	• Factory Mutual (FM)
	• National Building Code of Canada (NBC)
	• National Fire Protection Association (NFPA)
	• Technical Safety BC (formerly BC Safety Authority [BCSA])
	• Underwriters' Laboratories of Canada (ULC)
	• Leadership in Energy and Environmental Design (LEED)
	• Authority having jurisdiction (AHJ)
	  ○ Municipal bylaws
	  ○ Permits

2. Describe the application of codes and standards	• Design • Planning • Installation • Maintenance • Decommissioning

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C4 Use Manufacturer's Documentation

Objectives

To be competent in this area, the individual must be able to:

- Describe manufacturer and supplier documentation.
- Source manufacturer documentation.

LEARNING TASKS	CONTENT

1. Describe manufacturer and supplier documentation	• Types
	  ○ Tool and equipment documentation
	  ○ Material Safety and Data Sheets (MSDS)
	  ○ System component documentation
	  ○ Proprietary product documentation
	  ○ Product certifications
	• Information
	  ○ Installation instructions and requirements
	  ○ Operation and maintenance manuals
	  ○ Product specifications
	  ○ Warranty information

2. Source manufacturer documentation	• Manufacturer web-sites • Search engines • Archival sources • On-site documentation • Contact manufacturer • Local agencies

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C5 Perform Piping System Layout

Objectives

To be competent in this area, the individual must be able to:

- Describe piping system layout.
- Apply piping layout according to site conditions.

LEARNING TASKS	CONTENT

1. Describe piping system layout	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specfications
	• Routing
	• Penetrations
	• Site conditions
	• Materials
	• Components
	• Supports
	• Tools and equipment
	• Interference with other systems
	  ○ Electrical
	  ○ HVAC

2. Apply piping layout according to site conditions	• Safe work practices • Working drawings • Tools and equipment • Materials

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D1 Prepare Pipe and Tubing

Objectives

To be competent in this area, the individual must be able to:

- Describe piping and tubing.
- Describe methods of pipe support.
- Prepare pipe for joining and installation.

LEARNING TASKS	CONTENT

1. Describe piping and tubing	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specifications
	• Schedules/Standard Dimension Ratio (SDR)
	• Characteristics
	• Types
	  ○ Steel
	  – Carbon
	  – Stainless
	  – Galvanized
	  ○ Copper
	  ○ Plastic
	  – Thermoplastic
	  – Thermoset
	  ○ Asbestos-cement
	  ○ Ductile iron

2. Describe methods of pipe support	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specifications
	• Tools and equipment
	• Types
	  ○ Stands
	  ○ Hangers
	  ○ Supports
	  ○ Seismic
	  ○ Anchors
	  ○ Guides
	  ○ Bedding media
	• Compatibility with piping
	• Size
	• Spacing

LEARNING TASKS	CONTENT

3. Describe methods of protecting piping and tubing	• Elevation
	• Fasteners
	  ○ Beam clamps
	  ○ Post install anchors
	  ○ Pre-cast concrete inserts
	  ○ Toggle bolts
	• Structural restrictions
	• Insulation requirements
	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specfications
	• Water treatment
	  ○ Bioside inhibitor
	• Frost protection
	  ○ Insulation
	  ○ Heat trace
	  ○ Frost boxes
	• Corrosion protection
	  ○ Coatings
	  ○ Tape
	  ○ Cathodic
	  ○ Dielectric
	  ○ Sleeving
	• Mechanical damage
	  ○ Protective plates/shield
	  ○ Sleeving
	  ○ Bollards

4. Perform pre-installation inspection of piping and tubing	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specifications
	• Applications
	• Potential defects
	  ○ Pin holes
	  ○ Cracked fittings
	  ○ Bent ends
	  ○ Uneven casting
	  ○ Damaged pipe and coatings
	  ○ Debris
	• Environmental effects
	  ○ Ultraviolet (UV)
	  ○ Thermal effects

LEARNING TASKS	CONTENT
	○ Soil conditions • Inspection for damage ○ Visual ○ Verification of manufacturer's specifications ○ Sounding of ductile iron and plastic pipe, and fittings ○ Tactile • Interpretation of markings
5. Cut piping and tubing	• Safe work practices • Drawings and specifications • Manufacturers' specifications • Tools and equipment ○ Hacksaw ○ Bandsaw ○ Pipe/tube cutters ○ Reamers ○ File ○ Grinder – Cutting disks ○ Hydraulic cutters • Calculations • Inspection
6. Bend piping and tubing	• Safe work practices • Codes and regulations • Manufacturers' specifications • Terminology • Tools and equipment ○ Tube benders ○ Bending springs • Measurements ○ Angles ○ Offsets ○ Bends • Inspection
7. Prepare piping and tubing connections	• Safe work practices • Manufacturers' specifications • Tools and equipment • Measuring • Cutting burr removal • Reaming

LEARNING TASKS	CONTENT
	• Threading • Joint compound • Flaring • Sanding/filing • Flux • Beveling • Grooving • Inspection

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D2 Join Tube, Tubing and Pipe

Objectives

To be competent in this area, the individual must be able to:

- Join piping and tubing.

LEARNING TASKS	CONTENT

1. Describe piping and tubing jointing methods	• Safe work practices
	• Press-fit
	• Soldered
	• Brazed
	• Grooved
	• Flanged
	• Compression
	  ○ Ferule
	  ○ Flared
	• Swaged
	• Welded
	  ○ Solvent
	  ○ Fused
	• Threaded
	• Cut-grooved
	• Roll-grooved
	• Crimped
	• Expanded

2. Join piping and tubing	• Codes and regulations ○ AHJ • Manufacturers' specifications • Fittings • Tools and equipment • Assemble

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D3 Install Pipe and Tubing

Objectives

To be competent in this area, the individual must be able to:

- Install piping.
- Describe methods of structure penetration.

LEARNING TASKS	CONTENT
1. Describe the installation of piping and tubing	• Codes and regulations ○ AHJ • Manufacturers' specifications • Safe work practices • Selection for application • Tools and equipment • Layout

2. Install piping	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specifications
	• Selection
	  ○ Application
	• Tools and equipment
	• Piping supports
	• Structure penetration
	  ○ Sleeving

3. Describe factors affecting penetrations in structures	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specfications
	• Structural integrity
	• Fire separation
	• Interference with other building components and systems
	• Hidden components behind the surface
	• Electrical wiring
	• Reinforcing bars
	• Piping
	• Post tension cables
	• Sleeve installation
	  ○ Fabrication
	  ○ Canning
	  – Timing

LEARNING TASKS	CONTENT
4. Describe methods of structure penetration	○ Location ○ Sizing ○ Fastening • Sealing ○ Fire stopping ○ Water-proofing ○ Protecting pipe • Codes and regulations ○ AHJ • Manufacturers' specfications • Fire stopping ○ Doughnut type ○ Gasket type ○ Caulking ○ Mineral wool • Fire rating requirements • Required gaps • Sealing of vertical and horizontal penetrations • Selection of sealants according to specifications

Achievement Criteria

Performance — The learner will be able to:

- Prepare, join and install piping of the following types:
  - Plastic
  - Copper
  - Carbon steel
- Install fittings

Conditions — To be assessed during technical training.
The learner will be given:

- Drawings and specifications
- Tools and equipment
- Materials

Criteria — The learner will be evaluated on:

- Accuracy
- Neatness

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D4 Install Valves

Objectives

To be competent in this area, the individual must be able to:

- Describe valves.
- Describe the installation of valves.

LEARNING TASKS	CONTENT

1. Describe valves	• Codes and regulations
	  ○ AHJ
	• Manufacturers' specifications
	• Seating design
	• Types
	  ○ Butterfly
	  ○ Ball
	  ○ Gate
	  – Outside stem & yoke (OS&Y)
	  – Non-rising stem (NRS)
	  ○ Globe
	  – Needle
	  – Composition disc
	  ○ Check
	  ○ Pressure Reducing (PRV)
	  ○ Mechanical Safety Devices
	  – Pressure Relief
	  – Pressure Ratings
	• Application
	• Materials
	• Limitations
	  ○ Temperature
	  ○ Pressure

2. Describe the installation of valves	• Codes and regulations
	  ○ AHJ
	  ○ Locations
	  – Protection
	  ▪ Mechanical damage
	  ▪ Freezing
	  ○ Listings
	  ○ Restrictions
	  – Minimum closure time
	  – Approvals
	  – Accessibility

LEARNING TASKS	CONTENT

	• Manufacturers' specifications
	• Selection
	  ○ Applications
	  ○ Pressure limitations
	• Orientation
	• Accessibility

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D5 Install Fittings

Objectives

To be competent in this area, the individual must be able to:

- Select fittings.
- Install fittings.

LEARNING TASKS	CONTENT
1. Describe fittings	• Manufacturers' specifications • Types • Applications • Limitations

2. Describe fitting connection methods	• Threaded
	• Compression
	• Flared
	• Flanged
	• Crimped
	• Soldered/brazed
	• Mechanical
	• Solvent welded
	• Sealants
	  ○ Thread compound
	  ○ Teflon tape
	  ○ Gaskets
	  ○ O-rings

3. Install fittings	• Codes and regulations ○ AHJ • Manufacturers' specifications • Accessories • Tools and equipment • Assembly

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D6 Install Piping Components

Objectives

To be competent in this area, the individual must be able to:

- Identify piping components.
- Select sprinklers.

LEARNING TASKS	CONTENT

1. Identify piping components	• Types
	  ○ Sprinklers
	  ○ Nozzles
	  ○ Supports and hangers
	  ○ Drainage

2. Describe and select sprinklers	• Types
	  ○ Automatic
	  – Solder
	  – Bulb
	  – Open
	  ○ Standard spray
	  – Pendant
	  – Upright
	  – Sidewall
	  ○ Extended coverage
	  – Pendant
	  – Upright
	  – Sidewall
	  ○ Residential
	• Information
	  ○ Listings
	  ○ K-factor
	  ○ Temperature ratings
	  ○ Handling
	  ○ Precautions
	• Characteristics
	  ○ Deflector design/spray patterns
	  ○ Orifice size
	  ○ Temperature
	  – Rating
	  – Sensitivity
	  ○ Orientation

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E1 Install Wet Pipe Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe wet pipe systems.

LEARNING TASKS	CONTENT

1. Describe wet pipe systems	• Types
	  ○ Tree
	  ○ Gridded
	  ○ Looped
	  ○ Flow through
	  ○ Multi-purpose
	• Piping
	• Components
	• Characteristics
	• Operation

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E2 Install Dry Pipe Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe dry pipe systems.

LEARNING TASKS	CONTENT

1. Describe dry pipe systems	• Types
	  ○ Tree
	  ○ Looped
	• Piping
	• Components
	• Characteristics
	• Operation

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E3 Install Antifreeze Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe antifreeze systems.

LEARNING TASKS

1. Describe antifreeze systems

CONTENT

- Types
  - Glycerine
  - Propylene glycol
  - Ethylene glycol
  - Dyethylene glycol
- Piping
- Components
- Characteristics
- Operation
- Limitations

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E4 Install Preaction/Deluge Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe preaction and deluge systems.

LEARNING TASKS	CONTENT

1. Describe preaction and deluge systems	• Types
	  ○ Deluge
	  ○ Fixed water spray
	  ○ Non-interlock
	  ○ Single interlock
	  ○ Double interlock
	• Components
	• Characteristics
	• Operation
	• Limitations

Line (GAC): F USE COMMUNICATION TECHNIQUES

Competency: F1 Use Communication Techniques

Objectives

To be competent in this area, the individual must be able to:

- Describe effective communication practices.

LEARNING TASKS

1. Describe effective communication practices

CONTENT

- Verbal
- Non-verbal
  - Body language
  - Signals
- Active listening
  - Hearing
  - Interpreting
  - Reflecting
  - Responding
  - Paraphrasing
- Learning styles
  - See
  - Hear
  - Attempt
- Workplace responsibilities
  - Personal
    - Attitude
    - Harassment
    - Discrimination
  - Supervisor
  - Human Resources (HR)
- Toolbox meetings
  - Field Level Risk Assessment (FLRA)
    - Site specific safety requirements

Level 2

Sprinkler Fitter

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C1 Use Mathematics and Science

Objectives

To be competent in this area, the individual must be able to:

- Perform sprinkler system calculations.
- Describe pipe schedule systems.
- Describe hydraulic systems.

LEARNING TASKS	CONTENT

1. Perform sprinkler system calculations	• Trigonometry
	• Offsets
	• Pipe bends
	• Piping layouts
	• Static pressure
	• Residual pressure
	• Velocity
	• Friction loss
	  ○ Hazen-Williams
	  ○ Friction loss coefficient
	  ○ C value multiplier
	  ○ Equivalent length schedule 40 steel pipe
	  ○ Equivalent length modifier

2. Describe pipe schedule systems	• Schedules • Limitations • Classifications

3. Describe hydraulic systems	• Water supply
	• Velocity
	• Volume
	• Static pressure
	• Residual pressure
	• Pressure generation
	• Flow rate
	• Friction
	• Pressure loss formulas
	  ○ Hazen-Williams
	  ○ Friction loss
	  ○ Elevation loss

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C2 Interpret Drawings and Specifications

Objectives

To be competent in this area, the individual must be able to:

- Interpret drawings.
- Plan material take-offs.

LEARNING TASKS

1. Describe drawings

CONTENT

- Types
  - Architectural
  - Structural
  - Mechanical
  - Electrical
  - Shop
    - As built
    - Schedules
    - Submittals
    - Diagrams
    - Product data
- Specification sheets
- Components of a drawing set
  - Plan
    - Plot
    - Foundation
    - Floor
  - Elevation
  - Sections
  - Details
  - Title block
  - Revisions
  - Schedules
  - Legends
  - Keys
  - Borders
- Information contained
  - Building dimensions
  - Construction type
  - Room layout
  - Fixture locations
  - Finish details
- Symbols
  - Sprinklers

LEARNING TASKS	CONTENT
	○ Switches ○ Alarm devices ○ Valves – Water flow control – Backflow preventers – Regulators/pressure reducing valves – Hose valves – Drain valves – Angle globe – Outside Stem & Yoke (OS&Y) – Post indicator – Check valve – Relief valve ○ Above ground and below ground piping ○ Hydrants • Abbreviations • Terminology • Lists, calculations and formulas • Site considerations
2. Plan material take-offs	

Achievement Criteria

Performance	The learner will be able to plan a material take-off.
Conditions	To be assessed during technical training. The learner will be given: • A working drawing and specifications
Criteria	The learner will be evaluated on: • Accuracy • Inclusion • Legibility

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C3 Use Codes, Regulations and Standards

Objectives

To be competent in this area, the individual must be able to:

- Interpret the National Fire Protection Association Codes (NFPA).
- Describe hazard classifications and commodities.

LEARNING TASKS	CONTENT
1. Describe the National Fire Protection Association Codes (NFPA)	• Layout • Sections • Contents • Index • Annex • Tables • Definitions • Scope • Revisions

2. Interpret the National Fire Protection Association Codes (NFPA)	• NFPA 13, 14, 24, 72
	  ○ Scope
	  ○ Reference publications
	  ○ Definitions
	  ○ General
	  ○ Annex

3. Describe hazard classifications and commodities	• Classifications
	  ○ High pile storage
	  ○ Occupancy
	  – Light hazard
	  – Ordinary hazard
	  – Extra hazard
	  – Residential
	• Commodity classes
	  ○ I
	  ○ II
	  ○ III
	  ○ IV
	  ○ Plastic
	  – Group A
	  – Group B
	  – Group C

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C4 Use Manufacturer's Documentation

Objectives

To be competent in this area, the individual must be able to:

- Apply manufacturer's and supplier documentation.

LEARNING TASKS	CONTENT
1. Apply manufacturer's and supplier documentation	• Proprietary data sheets • Installation literature • Operation literature • Maintenance literature

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C5 Perform Piping System Layout

Objectives

To be competent in this area, the individual must be able to:

- Layout piping systems.

LEARNING TASKS	CONTENT
1. Layout pipe schedule system	• Codes and regulations • Piping materials • Hazard classification • Scaled dimensions • Tools and equipment • Safe work practices
2. Layout hydraulically calculated systems	• Codes and regulations • Piping materials • Hazard classification • Scaled dimensions • Tools and equipment • Safe work practices

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D3 Install Pipe and Tubing

Objectives

To be competent in this area, the individual must be able to:

- Apply code requirements for the installation of piping and tubing.

LEARNING TASKS	CONTENT
1. Describe code requirements for the installation of piping and tubing	• Codes and regulations ○ AHJ • Manufacturers' specifications • Clearances • Transition pieces • Reduction fittings • Compatibility considerations • Corrosive environments • Pitch and grade • Listings • Approvals • Pressure ratings • Welding • Penetration dimensions • Bending • Fitting restrictions • Joint compound • Exposed pipe limitations • End treatment • Minimum pipe sizes • Acceptable pipe types • Drainage

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D4 Install Valves

Objectives

To be competent in this area, the individual must be able to describe NFPA requirements for the installation of:

- Control valves.
- Drain valves.
- Test valves.
- Check valves and backflow preventers.
- Air venting valves.

LEARNING TASKS	CONTENT

1. Describe NFPA requirements for the general installation of valves	• Codes and regulations
	• AHJ approvals
	• Manufacturers' specifications
	• Minimum pressure ratings
	• Listings
	• Orientation
	• Location requirements
	  ○ Protection
	  – Mechanical damage
	  – Freezing
	• Restrictions
	  ○ Approvals
	  ○ Accessibility
	• Selection
	  ○ Applications
	  ○ Pressure limitations
	  ○ Site conditions
	• Identification signs
	  ○ Control
	  – Identify portion of building served
	  ○ Drain
	  ○ Test
	  ○ Venting
	  ○ System secondary control valve

2. Describe NFPA requirements for the installation of control valves	• System control valves
	  ○ Indicating
	  ○ Supervised

LEARNING TASKS	CONTENT
	○ Normally open ○ Normally closed • Floor control • Minimum closure time
3. Describe NFPA requirements for the installation of drain valves	• System drain valves ○ Main ○ Type ○ Appropriate water discharge method ○ Location ○ Size ○ Accessibility • Auxiliary drain valves ○ Wet systems – Location – Size – Capacity – Appropriate water discharge method – Accessibility ○ Dry systems – Location – Size – Capacity – Appropriate water discharge method – Accessibility
4. Describe NFPA requirements for the installation of test valves	• Location • Size • Accessibility • Capacity • Material • Appropriate water discharge method
5. Describe NFPA requirements for the installation of check valves and backflow preventers	• Location ○ Water supply ○ Valve trim ○ System ○ Drain ○ Fire department connection (FDC) • Size • Accessibility

LEARNING TASKS	CONTENT

	• Orientation
	• Isolation
	  ○ Control valves
	  ○ Exceptions
	• Approvals
	• Listings
	• Forward flow test facilitation (backflow preventer)
	• Retroactive installation (backflow preventer)

6. Describe NFPA requirements for the installation of air venting valves	• Location • System piping material type • System type • Size • Purpose • Approval • Manual or automatic

Line (GAC): D INSTALL PIPING AND COMPONENTS

Competency: D6 Install Piping Components

Objectives

To be competent in this area, the individual must be able to:

- Describe the installation of hangers and supports.
- Describe the installation of seismic protection.
- Describe the installation of drainage systems.
- Describe and select sprinklers.
- Describe the installation of sprinklers.

LEARNING TASKS

1. Describe the installation of hangers and supports

CONTENT

- Hangers
  - Adjustable swivel ring
  - Riser clamp
  - Clevice
  - Split ring
  - U-bolt
  - U-hook
  - Short strap
  - Listed
- Attachments
  - Ceiling flanges
  - Beam clamps
  - C-clamps
  - Side beam attachments
- Fasteners
  - Screws
  - Coach screw rods
  - Lag screws
  - Bolts
  - Rod couplings
- Anchors
  - Wedge
  - Undercut
  - Drop-in
  - Listed
- Threaded rod/Eye-rod
- Trapeze
  - Codes and regulations
    - Span
    - Section modulus

LEARNING TASKS	CONTENT
	– Component sizing – Materials – Load limitations • Hanger/support spacing o Pipe type o Pipe size o Available structural support points o Pipe orientation o Discharge obstructions o Unsupported lengths o Pressure above 100 PSI considerations • Compatibility o Dissimilar metals
2. Describe the installation of seismic protection	• NFPA requirements • AHJ • Bracing materials • Restraints o End of line • Joint flexibility o Penetrations o Risers o Drops
3. Describe drainage systems	• Types o Main o Auxilliary • Components • Piping
4. Describe the installation of drainage systems	• Safe work practices • Pipe sizing • Location • Drawings and specifications • Tools and equipment • NFPA requirements • AHJ
5. Describe and select sprinklers	• Types o Institutional o CMSA o ESFR

LEARNING TASKS	CONTENT
	○ Consealed ○ Recessed ○ In-rack ○ Attic ○ Old-style/conventional ○ Open sprinkler ○ Window ○ Corrosion resistant ○ Dry barrel • Information ○ Date of manufacture ○ Indentification number (SIN) ○ Coatings ○ Spare sprinkler headbox requirements
6. Describe the installation of sprinklers	• Location • Obstructions • Orientation • Proximity to heat sources

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E1 Install Wet Pipe Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe wet pipe systems components.
- Describe wet pipe system design criteria.
- Install wet pipe systems.

LEARNING TASKS

1. Describe wet pipe system components

CONTENT

- Alarm check valves
  - Types
    - Divided seat
    - Pilot port
  - Purpose
  - Application
  - Location
  - Orientation
    - Manufacturer's specification
    - NFPA standards
  - Sequence of operation
  - Alarm valve trim
    - Alarm line
      - Alarm line control valve
      - Strainer
      - Water motor alarm valve
      - Galvanized pipe
      - Pressure switch
      - Retard chamber
      - Alarm test valve
      - Pipe size
      - Automatic drain
    - False alarm mitigation
      - Retard chamber
      - Excess pressure pump
      - Internal/external bypasses
- Inspector's test
  - Location
  - Size
  - Orientation
  - Material
  - Purpose
  - Orifice size
  - Approval criteria

LEARNING TASKS	CONTENT

	• Wet system risers
	  ○ Shot gun risers
	  – Gauge
	  – Flow switch
	  – Test connection
	  – Drain connection
	  – Relief valve
	  – Joining technique
	  ○ Conventional system risers
	  – Gauge
	  – Control valves
	  – Flow switch
	  – Drain valve
	  – Riser check
	  – Relief valve
	  ○ Floor control and zone valve assemblies
	  – Gauge
	  – Control valve
	  – Flow switch
	  – Drain valve
	  – Test connection
	  – Check valve
	  ▪ Combined standpipe
	  ▪ Relief valve

2. Describe wet pipe system design criteria	• Hazards
	  ○ Light
	  ○ Ordinary
	  ○ Extra
	  ○ Storage
	• Density
	• Square footage
	  ○ Areas of operation
	• Occupancy types
	  ○ Residential
	  ○ Commercial
	  ○ Industrial
	• Location
	• Limitations
	  ○ Minimum maintained temperatures
	  ○ Square footage
	  ○ Acceptance requirements
	  – Hydrostatic test
	  – Alarm test

LEARNING TASKS	CONTENT

	• Water demand
	  ○ Gallons per minute (GPM)
	  ○ Pressure (PSI)
	• Hose stream allowance
	• Site conditions

3. Install wet pipe systems	• Safe work practices • Codes and regulations • Manufacturer's specfications • Tools and equipment • Piping pitch • Supports • Layout • Penetrations • Connections • Restraints • Assemble

Achievement Criteria

Performance — The learner will be able to trim an alarm check valve.

Conditions — To be assessed during technical training.
The learner will be given:

- Specifications
- Tools and equipment
- Materials

Criteria — The learner will be evaluated on:

- Code requirements
- Accuracy
- Function
- Appearance

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E2 Install Dry Pipe Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe dry pipe system components.
- Describe dry pipe system design criteria.
- Install dry pipe systems.

LEARNING TASKS

1. Describe dry pipe system components

CONTENT

- Dry pipe valves
  - Types
    - Differential
    - Latching
    - Low differential
  - Purpose
  - Application
  - Location
  - Orientation
    - Manufacturer's specifications
    - NFPA standards
  - Sequence of operation
  - Dry valve trim
    - Manufacturer's specifications
    - Alarm line
      - Check valve
      - Alarm line control valve
      - Strainer
      - Water motor alarm valve
      - Galvanized pipe
      - Pressure switch
      - Alarm test valve
      - Pipe size
      - Automatic drain
    - Air line
      - Low air supervisory (freezers)
      - Check valve
      - Isolation valve
      - Relief valve
      - Gauge
      - Air source
        - Shop air
        - Compressor
        - Air maintenance device
    - Quick opening devices (QOD)
      - Anti-flood device

LEARNING TASKS	CONTENT
	▪ Isolation valve ▪ Strainer ▪ Check valve ▪ Gauge • Inspector's test o Location o Size o Material o Purpose o Orifice size o Approval criteria • Dry system risers o Control valves o Drain valve o High water level protection o Gauges • Sprinklers o Upright o Dry o Sidewall o Pendants on return bends • Dry systems in refrigerated spaces (below 32°F/0°C) o Special requirements – Piping pitch – Auxiliary drain size – Dry air – Air intakes – Inspection piece – Dual air lines – Riser check valve – Dual air gauges – Trip test outlet – Isolation valve – Compressor manufacturer's specifications
2. Describe dry pipe system design criteria	• Hazards o Light o Ordinary o Extra o Storage • System volume • Density • Square footage

LEARNING TASKS	CONTENT
	○ Areas of operation • Occupancy types ○ Residential ○ Commercial ○ Industrial • Location • Limitations ○ System volume ○ Acceptance requirements – Water delivery – Pneumatic test – Hydrostatic test – Alarm test
3. Install dry pipe systems	• Safe work practices • Codes and regulations • Manufacturer's specfications • Tools and equipment • Piping pitch • Auxiliary drains ○ Condensate drain ○ Tie-in drain • Supports • Layout • Penetrations • Connections • Restraints • Assemble

Achievement Criteria

Performance — The learner will be able to trim a dry pipe valve.

Conditions — To be assessed during technical training.
The learner will be given:

- Specifications
- Tools and equipment
- Materials

Criteria — The learner will be evaluated on:

- Code requirements
- Accuracy
- Function
- Appearance

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E3 Install Antifreeze Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe antifreeze system components.
- Describe antifreeze system design criteria.
- Describe the installation of antifreeze systems.

LEARNING TASKS	CONTENT

1. Describe antifreeze system components	• Types
	  ○ Listed pre-mix
	  ○ Permitted field mixing
	  – Non-toxic
	  ▪ Glycerine
	  ▪ Propylene glycol
	  – Toxic
	  ▪ Ethylene glycol
	  ▪ Dieethylene glycol
	• Piping arrangement (loop)
	  ○ Control valve
	  ○ Fill cup
	  ○ Test, fill, & drain valves
	  ○ Drop pipe
	  ○ Check valve
	• Piping arrangement (backflow preventer)
	  ○ Reduced pressure principle backflow preventer (RP)
	  ○ Expansion chamber
	  ○ Forward flow test valve
	  ○ Fill cup
	  ○ Drain valve
	• Piping arrangement (backflow preventer – under 40 gal.)
	  ○ Reduced pressure principle backflow preventer (RP)
	  ○ Forward flow test valve
	  ○ Fill cup
	  ○ Test, fill, & drain valves
	  ○ Relief valve
	  ○ Drop pipe
	  ○ Check valve

LEARNING TASKS	CONTENT
2. Describe antifreeze system design criteria	• Density • Square footage • Occupancy • Location • Limitations

3. Describe the installation of antifreeze systems	• Codes and regulations
	• Manufacturer's specfications
	• Tools and equipment
	• Supports
	• Layout
	• Penetrations
	• Connections
	• Filling procedures
	• Restraints
	• Assemble
	• Test sampling
	  ○ Specific gravity/freezing point
	  – Hydrometer
	  – Refractometer

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E4 Install Preaction/Deluge Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe preaction system components.
- Describe deluge system components.
- Describe preaction and deluge system design criteria.
- Describe the installation of preaction and deluge systems.

LEARNING TASKS

1. Describe preaction system components

CONTENT

- Preaction valve
- Preaction valve trim
    - Manufacturer's specifications
    - Alarm line
        - Check valve
        - Alarm line control valve
        - Strainer
        - Water motor alarm valve
        - Galvanized pipe
        - Pressure switch
        - Alarm test valve
        - Pipe size
        - Automatic drain
    - Supervisory air line
        - Low air supervisory
        - Check valve
        - Isolation valve
        - Relief valve
        - Gauge
        - Air source
            - Shop air
            - Compressor
            - Air maintenance device
    - Quick opening devices (QOD)
        - Anti-flood device
        - Isolation valve
        - Strainer
        - Check valve
        - Gauge
- Detection system
    - Purpose
    - Types

LEARNING TASKS	CONTENT
	– Pilot – Electric • Valve release (valve actuation) o Manual o Hydraulic o Pneumatic o Solenoid • System drainage o Piping pitch o Valve sizes • Test connection o Single and non-interlock o Double interlock
2. Describe deluge system components	• Deluge valve • Deluge valve trim o Manufacturer's specifications o Alarm line – Check valve – Alarm line control valve – Strainer – Water motor alarm valve – Galvanized pipe – Pressure switch – Alarm test valve – Pipe size – Automatic drain • Detection system o Purpose o Types – Pilot – Electric o Testing • Valve release (valve actuation) o Manual o Hydraulic o Pneumatic o Solenoid • System drainage o Piping pitch • Valve sizes
3. Describe preaction and deluge system design criteria	• Hazards o Light

LEARNING TASKS	CONTENT
	○ Ordinary ○ Extra ○ Storage • Pipe schedule • Calculated • Maximum size requirements • Density • Square footage • Occupancy types ○ Residential ○ Commercial ○ Industrial • Location • Limitations ○ System volume – Double interlock ○ Acceptance requirements – Water delivery ▪ Double interlock – Pneumatic test ▪ Preaction – Hydrostatic test – Alarm test
4. Describe the installation of preaction and deluge systems	• Codes and regulations • Manufacturer's specfications • Tools and equipment • Piping pitch • Auxiliary drains ○ Condensate drain ○ Tie-in drain • Supports • Layout • Penetrations • Connections • Restraints • Assemble

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E5 Install Standpipe Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe standpipe systems and components.
- Describe standpipe system design criteria.
- Describe the installation of standpipe systems.

LEARNING TASKS	CONTENT

1. Describe standpipe systems	• Types
	  ○ Combined
	  ○ Automatic wet
	  ○ Manual wet
	  ○ Automatic dry
	  ○ Manual dry
	  ○ Semi-automatic dry
	• Classifications
	  ○ I
	  ○ II
	  ○ III
	• Piping
	• Components
	• Characteristics
	• Operation

2. Describe standpipe system components	• Hose valves
	  ○ 2 ½ in.
	  ○ 1 ½ in.
	  ○ Pressure reducing valve (PRV)
	• Hose stations
	  ○ 1 ½ in. trained occupant use
	  ○ Pressure reducing valve (PRV)
	  ○ Pressure restricting devices
	• Drains
	  ○ Drain riser (express)
	  ○ Main
	• Control valves
	  ○ Isolation valves
	• Check valves
	• Flow switch
	• Deluge valve

LEARNING TASKS	CONTENT
	○ Remote actuation station • Dry valve
3. Describe standpipe system design criteria	• Pipe schedule • Hydraulic calculations • Minimum pipe sizing • Minimum flow rate • Minimum and maximum pressures • Travel distance • Occupancy • Location • Limitations
4. Describe the installation of standpipe systems	• Codes and regulations • Manufacturer's specfications • Tools and equipment • Supports • Layout ○ Travel distance • Penetrations • Connections • Restraints • Assemble

Line (GAC): G INSTALL WATER SUPPLY

Competency: G1 Install Underground Water Supply

Objectives

To be competent in this area, the individual must be able to:

- Describe underground piping and components.
- Describe underground piping layout.
- Describe hydrant application and installation.
- Describe the installation of underground piping

LEARNING TASKS	CONTENT

1. Describe underground piping and components	• Pipe
	  ○ Cast iron
	  ○ Ductile iron
	  ○ Asbestos cement
	  ○ Plastic
	  ○ Copper
	• Components
	  ○ Gate valves
	  ○ Post indicating valves (PIVs)
	  ○ Fire hydrants
	  ○ Thrust blocks
	  ○ Restraints
	• Fittings
	  ○ Saddles
	  ○ Compression
	  ○ Flanged
	  ○ Ro-bar couplings

2. Describe underground piping layout	• Safe work practices • Codes and regulations ○ AHJ • Offsets • Components • Trenching • Supports • Bedding • Restraints

3. Describe hydrant application and installation	• Safe work practices
	• Codes and regulations
	  ○ AHJ
	  – Connections

LEARNING TASKS	CONTENT

4. Describe the installation of underground piping	– Markings
	• Operation
	  ○ Slide gate
	  ○ Compression type
	• Types
	  ○ Wet barrel
	  ○ Dry barrel
	• Thrust blocks/restraints
	• Drainage requirements
	• Safe work practices
	• Codes and regulations
	  ○ AHJ
	• Pipe preparation
	  ○ Cutting
	  ○ Filing
	  ○ Beveling
	  ○ Cleaning
	  ○ Lubricating
	• Layout
	• Identification
	• Bedding
	• Rodding
	• Assembly
	• Protection
	  ○ Cathodic
	  ○ Corrosion
	• Connections
	• Clearances
	• Seals
	• Terminations
	• Testing
	  ○ Hydrostatic
	• Flushing
	  ○ Hydraulic
	  ○ Hydro-pneumatic
	  ○ Flow rates
	  ○ Chlorination
	• Commissioning
	  ○ Material and test certificate

Line (GAC): G INSTALL WATER SUPPLY

Competency: G2 Install Fire Department Connections

Objectives

To be competent in this area, the individual must be able to:

- Describe the installation of fire department connections.

LEARNING TASKS	CONTENT
1. Describe fire department connection components	• Check valve • Ball drip • Caps/plugs

2. Describe the installation of fire department connections	• Type
	• Codes and regulations
	  ○ AHJ
	• Location
	  ○ Drawings and specifications
	  ○ NFPA
	  ○ AHJ
	• Sizing
	• Components
	• Connections

Line (GAC): G INSTALL WATER SUPPLY

Competency: G5 Install and Test Cross Connection Control Components

Objectives

To be competent in this area, the individual must be able to:

- Describe cross connection control.
- Install cross connection control components.
- Test cross connection control components.

LEARNING TASKS	CONTENT

1. Describe cross connection control	• Hazards
	  ○ Minor, moderate, severe
	• Assemblies
	  ○ Reduced pressure backflow preventer assembly (RPBA)
	  ○ Double check valve assembly (DCVA)
	  ○ Pressure Vacuum Breaker Assembly (PVBA)
	  ○ Air gap
	• Inspection
	• Methods
	• Maintenance
	  ○ Calibration
	  ○ Annual verification
	• Codes, regulations and permits
	  ○ AHJ
	  ○ NPC, Section 7, Non-Potable Water Systems
	• Certification

2. Install cross connection control components	• Safe work practices
	• Hazard assessment
	  ○ Minor, moderate, severe
	• Installation requirements
	  ○ Height
	  ○ Location
	  ○ Accessibility
	• Codes, regulations and permits
	  ○ NFPA
	  ○ BCWWA
	  ○ AHJ
	  ○ National Plumbing Code

LEARNING TASKS	CONTENT
	(NPC) ○ Canadian Standards Association (CSA) • Tools and equipment • Connections • Pressures • Inspection • Testing
3. Test cross connection control components	• Safe work practices • Assemblies ○ Reduced Pressure Backflow Assembly (RPBA) ○ Double-check Valve Assembly (DCVA) ○ Pressure Vacuum Breaker Assembly (PVBA) ○ Air gap • Devices ○ Dual check Valve ○ Dual check Valve Backflow Preventer with Atmospheric Port ○ Dual check Valve Backflow Preventer with Vent ○ Atmospheric Vacuum Breaker ○ Hose Connection Vacuum Breaker ○ Labroratory Faucet Type Vacuum Breaker • Test procedures • Purpose • Minimum requirements • Test frequency • Documentation

Achievement Criteria

Performance — The learner will be able to install and test cross connection components required for certification.

Conditions — To be assessed during technical training.
The learner will be given:
- Assemblies
- Test equipment
- Documentation

Criteria — The learner will be evaluated on:
- Current accepted certification test procedures and equipment

Line (GAC): H INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES

Competency: H1 Install Detection Systems and Devices

Objectives

To be competent in this area, the individual must be able to:

- Describe pilot lines and components.
- Describe the installation of pilot lines.
- Describe electric detection systems.
- Describe heat actuated devices (HADs) and components.
- Describe the installation of heat actuated devices (HADs).

LEARNING TASKS	CONTENT

1. Describe pilot lines	• Types
	  ○ Wet
	  ○ Dry
	• Components
	  ○ Fixed temperature heat actuated device (HAD)
	  ○ Detectors
	  ○ Pull stations
	• Characteristics
	• Applications

2. Describe the installation of pilot lines	• Safe work practices
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Sizing
	  ○ Spacing
	  ○ Connections
	  ○ Testing

3. Describe electric detection systems	• Components • Characteristics • Applications

4. Describe heat actuated devices (HADs)	• Types
	  ○ Fixed temperature
	  ○ Rate of rise
	  ○ Linear heat
	• Operation
	• Applications

LEARNING TASKS	CONTENT

5. Describe the installation of heat actuated devices (HADs)	• Safe work practices
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Sizing
	  ○ Spacing
	  ○ Connections
	  ○ Testing

Line (GAC): H INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES

Competency: H2 Install Alarm Initiating Devices

Objectives

To be competent in this area, the individual must be able to:

- Describe alarm-initiaing devices and components.
- Install of alarm-initiating devices.
- Describe supervisory-initiaing devices and components.
- Describe the installation of supervisory-initiating devices.

LEARNING TASKS	CONTENT

1. Describe alarm-initiating devices	• Types
	  ○ Paddle-type flow
	  ○ Pressure
	• Characteristics
	• Applications

2. Install alarm-initiating devices	• Safe work practices
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Selection
	  ○ Location
	  ○ Testing

3. Describe supervisory-initiating devices	• Types
	  ○ Low/high air pressure
	  ○ Low/high water pressure
	  ○ Tamper
	• Characteristics
	• Applications

4. Install supervisory-initiating devices	• Safe work practices
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Selection
	  ○ Location
	  ○ Testing

Achievement Criteria

Performance	The learner will be able to: • Install an alarm-initiating device • Install a supervisory-initiative device
Conditions	To be evaluated during technical training. The learner will be given: • Tools and equipment • Drawings and specifications • Materials
Criteria	The learner will be evaluated on: • Accuracy • Operation

Line (GAC): I COMMISSION AND MAINTAIN SYSTEMS

Competency: I1 Commission Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe water supply testing and procedures.
- Describe fire protection system testing and procedures.

LEARNING TASKS	CONTENT
1. Describe water supply testing and procedures	• Safe work practices • Hazards • Hydrostatic test • Flushing • Chlorination
2. Describe fire protection system testing and procedures	• Safe work practices • Hazards • Hydrostatic test • Pneumatic test

Level 3

Sprinkler Fitter

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITES

Competency: C2 Interpret Drawings and Specifications

Objectives

To be competent in this area, the individual must be able to:

- Describe contractual documents.
- Describe record management.
- Prepare a bid.

LEARNING TASKS	CONTENT

1. Describe contractual documents	• Purpose
	• Types
	  ○ Agreements
	  ○ General conditions
	  ○ Drawings
	  ○ Specifications
	  – Master format
	  – Divisions
	• General requirements
	• Responsibilities and obligations
	  ○ Permits and requirements
	  ○ Guarantees/warranties
	  ○ Liability
	  ○ Tests and inspections
	  ○ Workmanship
	• Change orders
	• Request for information (RFI)

2. Describe record management	• Written/electronic daily log • Service reports • Invoices • Time sheets • Purchase orders • Vehicle logs • Maintenance logs • Inventory • Permits • Statements of completion

Achievement Criteria

Performance	The learner will be able to prepare a bid for a sprinkler system arrangement: • Minimum of 15 sprinkler heads • Including all components necessary to meet the minimum requirements of the applicable NFPA standard.
Conditions	To be assessed during technical training. The learner will be given: • Design criteria • Specifications
Criteria	The learner will be evaluated on: • Accuracy • Inclusion • Legibility

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C3 Use Codes, Regulations and Standards

Objectives

To be competent in this area, the individual must be able to:

- Interpret the National Fire Protection Association Codes (NFPA).

LEARNING TASKS	CONTENT

1. Interpret the National Fire Protection Association Codes (NFPA)	• NFPA 10, 12, 13, 13D, 13R, 16, 20, 22, 25
	  ○ Scope
	  ○ Reference publications
	  ○ Definitions
	  ○ General
	  ○ Annex

Line (GAC): C PERFORM ROUTINE TRADE ACTIVITIES

Competency: C5 Perform Piping System Layout

Objectives

To be competent in this area, the individual must be able to:

- Layout piping systems.
- Layout multiple and single family dwelling sprinkler systems.

LEARNING TASKS	CONTENT
1. Layout piping systems	• Sprinkler head locations • Branch line locations • Main locations • System riser location • Water supply to system riser • Hanger locations • Seismic equipment locations • Pipe sizing • Centre to centre lengths • Details for clarifications • Title block • Legend • Valve station schematic • Specifications • Application of standards • Plan and elevation views • Orthographic and isometric projections • General notes

2. Layout multiple and single family dwelling sprinkler systems	• NFPA 13D and 13R design criteria
	  ○ Pipe sizing
	  ○ Discharge requirements
	  ○ Water supply requirements
	  ○ Listed pipe and fittings

Achievement Criteria 1

Performance	The learner will be able to layout multiple and single family dwelling sprinkler systems.
Conditions	To be assessed during technical training. The learner will be given: • Drafting paper • Assignment requirement document • Verbal instructions and demonstrations • Specifications
Criteria	The learner will be evaluated on: • Accuracy • Inclusions • Legibility • Complexity

Achievement Criteria 2

Performance	The learner will be able to layout a piping system.
Conditions	To be assessed during technical training. The learner will be given: • Drafting paper • Assignment requirement document • Verbal instructions and demonstrations • Specifications
Criteria	The learner will be evaluated on: • Accuracy • Inclusions • Legibility • Complexity

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E6 Install Foam Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe foam systems and components.
- Describe foam system design criteria.
- Describe the installation of foam systems.

LEARNING TASKS	CONTENT

1. Describe foam systems	• Types
	  ○ Foam water sprinkler
	  ○ Foam water spray
	• Piping
	• Components
	• Characteristics
	• Operation
	• Applications
	  ○ Petro-chemical storage
	  ○ Alcohol storage
	  ○ Petro-chemical spill protection

2. Describe foam system components	• Foam concentrate
	  ○ Types
	  – Aqueous Film Forming Foam (AFFF)
	  – Film Forming Fluoroprotein (FFFP)
	  – Protein foam
	  – Alcohol resistant (AR)
	  ○ High expansion
	  ○ Low expansion
	• Foam concentrate tank
	• Water supply
	• Control valve
	• Automatic flow valve
	• Proportioners
	• Discharge devices
	  ○ Air aspirating
	  ○ Non-air aspirating
	  ○ Foam chambers
	  ○ Foam generators

LEARNING TASKS	CONTENT
	○ Monitors • Flushing connections • Test connections
3. Describe foam system design criteria	• Area of hazard • Application rate of foam solution • Discharge duration • Type of fuel ○ Hydrocarbon ○ Alcohol • Pipe sizing • Spacing of discharge devices • Flow rate • Pressures • Location • Limitations
4. Describe the installation of foam systems	• Codes and regulations • Manufacturer's specfications • Tools and equipment • Supports • Layout ○ Underground pipe • Penetrations • Connections • Restraints • Assemble

Line (GAC): E INSTALL WATER-BASED SYSTEMS

Competency: E7 Install Water Mist and Hybrid Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe water mist and hybrid systems.
- Describe water mist and hybrid system components.
- Describe water mist and hybrid system design criteria.
- Describe installation of water mist and hybrid systems.

LEARNING TASKS	CONTENT

1. Describe water mist and hybrid systems	• Types
	  ○ Single fluid
	  ○ Twin fluid
	  ○ High pressure
	  ○ Low pressure
	• Piping
	• Components
	• Characteristics
	• Operation
	• Applications

2. Describe water mist and hybrid system components	• High pressure pumps
	  ○ Positive displacement
	• Propellant gas cylinders
	  ○ Nitrogen
	• Water tanks
	• Relief valves
	• High pressure control manifolds
	• Air and water supply connections
	• Pipe schedule 40 minimum
	• Malleable fittings minimum up to 300 PSI
	• Extra heavy pipe above 300 PSI
	• Forged fittings above 300 PSI

3. Describe water mist and hybrid system design criteria	• Pipe sizing • Flow rate • Pressures • Manufacturers' specifications • Location • Type of hazard

4. Describe installation of water mist and hybrid systems	• Codes and regulations • Manufacturer's specfications • Tools and equipment • Supports • Layout • Penetrations • Connections • Restraints • Assemble

Line (GAC): F USE COMMUNICATION TECHNIQUES

Competency: F2 Use Mentoring Techniques

Objectives

To be competent in this area, the individual must be able to:

- Use mentoring techniques.

LEARNING TASKS	CONTENT

1. Describe effective mentoring techniques	• Verbal
	• Non-verbal
	  ○ Body language
	  ○ Signals
	• Active listening
	  ○ Hearing
	  ○ Interpreting
	  ○ Reflecting
	  ○ Responding
	  ○ Paraphrasing
	• Personal responsibilities
	  ○ Attitude
	  ○ Harassment
	  ○ Descrimination

2. Describe learning strategies	• Coaching
	• Practice
	• Assessing
	  ○ Feedback
	  ○ Correcting
	• Reinforcement

3. Describe outcomes of effective coaching	• Protocols • Responsibilities • Punctuality • Safety • Collaboration

Line (GAC): G INSTALL WATER SUPPLY

Competency: G3 Install Fire Pump Units

Objectives

To be competent in this area, the individual must be able to:

- Describe pumps and their operation.
- Describe fire pumps and components.
- Describe the installation of fire pump units.

LEARNING TASKS	CONTENT

1. Describe pumps and their operation	• Types
	  ○ Non-positive displacement
	  – Single stage
	  – Multi-stage
	  ○ Positive displacement
	• Layout
	  ○ Series
	  ○ Parallel
	• Bernoulli's effect
	• Head pressure
	• Net pump suction head
	• Laminar flow
	• Turbulent flow

2. Describe fire pumps, components and their operation	• Fire pump types
	  ○ Horizontal shaft split case
	  ○ Vertical in-line
	  ○ End suction
	  ○ Vertical shaft
	• Other pump types
	  ○ Jockey
	  ○ Excess pressure
	• Components
	  ○ Power sources
	  ○ Controllers
	  – Transfer switch
	  – Disconnects
	  – Sensing lines
	  ○ Valves
	  – Check
	  – Relief
	  – Control
	  – Hose

LEARNING TASKS	CONTENT
	– Automatic air release ○ Pressure gauges ○ Drains ○ Strainer/trash screen ○ Fittings – Reducers ▪ Eccentric ▪ Concentric ○ Drivers – Electric – Diesel – Steam turbine
3. Describe the installation of fire pump units	• Hazards • Safe work practices • Codes and regulations ○ AHJ ○ Manufacturer's documentation • Layout ○ Drawings and specfications • Alignment • Raised pads ○ Materials – Shims – Mounts – Grout – Cement • Testing • Commissioning ○ Manufacturer's representative

Line (GAC): G INSTALL WATER SUPPLY

Competency: G4 Install Private Water Supply Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe private water supply systems and components.
- Describe the layout private water supply piping.
- Describe the installation of private water supply systems.

LEARNING TASKS	CONTENT

1. Describe private water supply systems and components	• Types
	  ○ Public
	  ○ Stored source
	  – Tanks
	  ▪ Elevated
	  ▪ Pressure
	  ▪ Gravity
	  ▪ Below-grade
	  ▪ Lakes/ponds
	  ▪ Wells
	  ○ Fire department connection
	• Components
	  ○ Valves
	  ○ Fittings
	  ○ Piping
	  ○ Accessories
	  ○ Restraints
	• Connections
	• Controlling devices
	  ○ Agitators
	  ○ Thermostats
	  ○ Auto-fill valves
	  ○ Pressure switches
	  ○ Control valves

2. Describe the layout private water supply piping	• Codes and regulations
	  ○ AHJ
	• Drawings and specifications
	• Component placement
	  ○ Hydrants
	  – Wall
	  – Roof
	  – Dry barrel
	  – Wet barrel

LEARNING TASKS	CONTENT
3. Describe the installation of private water supply systems	○ Anti-vortex plate ○ Fill line • Safe work practices • Hazards • Codes and regulations ○ AHJ • Layout ○ Drawings and specifications • Equipment • Protection ○ Cathodic ○ Corrosion • Assembly • Testing • Commissioning

Line (GAC): H Install Fire Suppression Systems and Devices

Competency: H1 Install Detection Systems and Devices

Objectives

To be competent in this area, the individual must be able to:

- Describe air sampling systems and components.
- Describe electrical detection systems and components.
- Describe the installation of air sampling systems.
- Describe the installation of electrical detection systems.

LEARNING TASKS	CONTENT

1. Describe air sampling systems	• Components
	  ○ Sampling/activation panels
	  ○ Tubing
	  ○ Sampling point
	• Characteristics
	• Applications

2. Describe the installation of air sampling systems	• Safe work practices
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Sizing
	  ○ Spacing
	  ○ Connections
	  ○ Testing
	  ○ Maintenance

3. Describe electrical detection systems	• Types
	  ○ Single zone
	  ○ Cross zone
	  ○ Addressable
	  ○ Conventional
	• Components
	  ○ Smoke detectors
	  ○ Heat detectors
	  ○ Releasing panels
	  ○ Pull stations
	• Characteristics
	• Applications

4. Describe the installation of electrical detection systems	• Safe work practices • Hazards • Codes, regulations, drawings and specifications ○ AHJ

Line (GAC): H INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES

Competency: H3 Install Dry and Wet Chemical, Clean Agent and Carbon Dioxide Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe dry and wet chemical, clean agent and carbon dioxide systems and components.
- Describe the installation of dry and wet chemical, clean agent and carbon dioxide systems.

LEARNING TASKS	CONTENT

1. Describe dry and wet chemical, clean agent and carbon dioxide systems and components	• Types
	  ○ Dry chemical
	  ○ Wet chemical
	  ○ Clean agent
	  ○ Carbon dioxide
	  – High pressure
	  – Low pressure
	• Components
	  ○ Alarms
	  ○ Indicators
	  ○ Life safety provisions
	  ○ Discharge nozzles
	  ○ Piping
	  ○ Fittings
	  ○ Supports
	  ○ Tanks
	  ○ Manifolds
	  ○ Release mechanisms
	  ○ Detection devices
	  ○ Pressure relief venting
	• Characteristics
	• Applications
	• Operation

2. Describe the installation of dry and wet chemical, clean agent and carbon dioxide systems	• Safe work practices
	  ○ Accidental discharge
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Sizing
	  ○ Spacing
	  ○ Connections

LEARNING TASKS	CONTENT
	○ Testing ○ Maintenance

Line (GAC): H INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES

Competency: H4 Install Portable Fire Extinguishers

Objectives

To be competent in this area, the individual must be able to:

- Describe the installation of portable fire extinguishers.

LEARNING TASKS

1. Describe the installation of portable fire-extinguishers

CONTENT

- Safe work practices
- Hazards
- Codes, regulations, drawings and specifications
    - AHJ
    - Types
        - Wet chemical
        - Dry chemical
        - Clean agent
        - Water-based
        - Carbon dioxide
    - Location
    - Inspection
    - Maintenance

Line (GAC): H INSTALL FIRE SUPPRESSION SYSTEMS AND DEVICES

Competency: H5 Install Spark Detection Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe spark detection systems.
- Describe the installation of spark detection systems.

LEARNING TASKS	CONTENT

1. Describe spark detection systems	• Components
	  ○ Solenoids
	  ○ Nozzles
	  ○ Spark detectors
	• Characteristics
	• Applications
	• Operation

2. Describe the installation of spark detection systems	• Safe work practices
	• Hazards
	• Codes, regulations, drawings and specifications
	  ○ AHJ
	  ○ Sizing
	  ○ Spacing
	  ○ Connections
	  ○ Testing
	  ○ Maintenance

Line (GAC): I COMMISSION AND MAINTAIN SYSTEMS

Competency: I1 Commission Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe water supply commissioning documentation.
- Describe fire protection system commissioning documentation.

LEARNING TASKS	CONTENT

1. Describe water supply commissioning documentation	• Contractor's material and testing certificate underground piping
	  ○ Acceptance plans
	  ○ Equipment used is approved
	  ○ Instructions
	  ○ Underground pipes and joints
	  ○ Flushing test
	  ○ Hydrostatic test
	  ○ Leakage test
	  ○ Forward flow test of backflow preventer
	  ○ Hydrants
	  ○ Control valves
	  ○ Date left in service
	  ○ Signatures
	  – Authorized agent
	  – Sprinkler contractor

2. Describe fire protection system commissioning documentation	• Contractor's material and testing certificate above ground piping
	  ○ Acceptance plans
	  ○ Equipment used is approved
	  ○ Instructions
	  ○ Sprinklers
	  ○ Pipe and fittings
	  ○ Alarm valve or flow indicator
	  ○ Dry pipe operating test
	  ○ Deluge and preaction valves
	  ○ Presure reducing valve test
	  ○ Backflow device forward flow test
	  ○ Hydrostatic test
	  ○ Dry piping pneumatic test
	  ○ Equipment operation verification

LEARNING TASKS	CONTENT
	○ Drain test ○ Flushing of underground piping verified ○ Welding ○ Cut outs and slag ○ Name plate ○ Caps and straps removed ○ Date left in service with all control valves open ○ Signatures – Authorized agent – Sprinkler contractor

Line (GAC): I COMMISSION AND MAINTAIN SYSTEMS

Competency: I2 Inspect and Test Fire Protection Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe the testing and inspection of fire protection systems.
- Describe the inspection of portable fire extinguishers.

LEARNING TASKS	CONTENT

1. Describe the testing and inspection of fire protection systems	• Safe work practices
	• Potential hazards
	  ○ Confined space
	  ○ Fall protection
	  ○ Electrical
	  ○ Environment
	• Owner notification
	• Codes and regulations
	  ○ NFPA 25
	  – Exceptions
	  ○ AHJ
	• Liabilities
	• Inspection frequency
	• Impairments
	  ○ Pre-planned
	  ○ Emergency
	• Deficiencies
	  ○ Critical
	  ○ Non-critical
	• Shut-down
	• Start-up
	• Inspection documentation
	  ○ Types
	  – NFPA
	  – Owner
	  – Company policy
	  ○ Components/devices
	  ○ Piping
	  ○ Pumps

2. Describe the inspection of portable fire extinguishers	• Codes and regulations ○ AHJ • Condition

LEARNING TASKS	CONTENT

	• Location
	• Liabilities
	• Inspection frequency
	• Verification
	  ○ Hoses
	  ○ Nozzles
	  ○ Hydrostatic tests
	  ○ Gauge pressure
	  ○ Cylinder weight
	  ○ Unit location
	• Inspection documentation

Line (GAC): I COMMISSION AND MAINTAIN SYSTEMS

Competency: I3 Maintain and Repair Fire Protection Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe the maintenance and troubleshooting of fire protection systems.
- Describe the repair of fire protection systems.

LEARNING TASKS	CONTENT
1. Describe the maintenance and troubleshooting of fire protection systems	• Maintenance frequency • Owner notification • Codes, regulations and specifications ○ AHJ • Tools and equipment • Shut down • Verify reported problem • Return to service • Documentation

2. Describe the repair of fire protection systems	• Safe work practices
	  ○ Confined space
	  ○ Point of access
	  ○ Shoring
	• Tools and equipment
	• Shut down
	• Repair or replace components
	• Testing
	• Return to service
	• Documentation

Section 4

ASSESSMENT GUIDELINES

Assessment Guidelines – Level 1

Level 1 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	SPRINKLER FITTER LEVEL 1		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	Perform Safety Related Functions	10%	0%
B	Use Tools and Equipment	10%	20%
C	Perform Routine Trade Activities	50%	30%
D	Install Piping and Components	15%	50%
E	Install Water-Based Systems	13%	0%
F	Use Communication Techniques	2%	0%
	Total	100%	100%
In-school theory / practical subject competency weighting		70%	30%
Final in-school mark Apprentices must achieve a minimum of 70% for the final in-school mark to be eligible to write the Sprinkler Fitter Standardized Level exam.		IN-SCHOOL %	

In-school Mark Combined theory and practical subject competency multiplied by	80%
Standardized Level Exam Mark The exam score is multiplied by	20%
Final Level Mark	100%

Assessment Guidelines – Level 2

Level 2 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	SPRINKLER FITTER LEVEL 2		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
C	Perform Routine Trade Activities	25%	10%
D	Install Piping and Components	15%	0%
E	Install Water-Based Systems	20%	45%
G	Install Water Supply	25%	35%
H	Install Fire Suppression Systems and Devices	10%	10%
I	Commission and Maintain Systems	5%	0%
	Total	100%	100%
In-school theory / practical subject competency weighting		75%	25%
Final in-school mark Apprentices must achieve a minimum 70% for the final in-school mark to be eligible to write the Sprinkler Fitter Standardized Level exam.		IN-SCHOOL %	

In-school Mark Combined theory and practical subject competency	80%
Standardized Level Exam Mark The exam score is multiplied by	20%
Final Level Mark	100%

Assessment Guidelines – Level 3

Level 3 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	SPRINKLER FITTER LEVEL 3		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
C	Perform Routine Trade Activities	30%	100%
E	Install Water-Based Systems	13%	0%
F	Use Communication Techniques	2%	0%
G	Install Water Supply	20%	0%
H	Install Fire Suppression Systems and Devices	10%	0%
I	Commission and Maintain Systems	25%	0%
	Total	100%	100%
In-school theory / practical subject competency weighting		80%	20%
Final in-school mark Apprentices must achieve a minimum 70% as the final in-school percentage score to be eligible to write the Interprovincial Red Seal exam.		IN-SCHOOL %	

All apprentices who complete Level 3 of the Sprinkler Fitter program with a FINAL level percentage score of 70% or greater will write the Interprovincial Red Seal examination as their final assessment.

SkilledTradesBC will enter the apprentices' Sprinkler Fitter Interprovincial Red Seal examination percentage score into SkilledTradesBC Portal.

A minimum percentage score of 70% on the examination is required for a pass.

Section 5

TRAINING PROVIDER STANDARDS

Facility Requirements

Classroom Area

- Minimum 22 square feet per student
- Compliance with the local and national fire code and occupational safety requirements
- Meets applicable municipal zoning bylaws for technical instruction and education facilities
- Comfortable seating and tables suitable for learning
- Overhead and multimedia projectors and screen
- Whiteboard with marking pens and erasers
- Heating/air conditioning
- Lighting controls (windows and fixtures) for screen viewing
- Acoustics that allow audibility of the instructor

Shop Area

- Minimum 3000 square feet of shop area including a tool crib and work stations
- Minimum 10 foot ceiling height in shop areas
- Minimum 8 foot ceiling in lab areas
- Adequate heating, lighting and ventilation
- Refuse and recycling bins for used shop materials
- First-aid equipment
- Shops will support practical requirements as outlined in the program outline

Lab Requirements

- See shop area requirements

Student Facilities

- Adequate eating area as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)
- Adequate washroom facilities as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)

Instructor's Office Space

- Adequate space for student consultation
- Desk with chair and filing space
- Computer
- Internet access
- Printer
- Stationary
- Adequate storage facilities for material and training aids
- Access to photocopier
- Telephone

Tools and Equipment

Shop (Facility) Tools and Equipment

Hand Tools

- Adjustable wrench
- Ball-peen hammer
- Head wrench
- Broom
- Caulking gun
- Chalk line
- Chisels
- Centering tools
- Claw hammer
- Combination wrench
- Depth gauges
- Drywall saw
- Flashlight
- Hacksaw
- Hand saw
- Hex keys (set)
- Hole saw
- Knife
- Levels
- Pick
- Pipe wrench
- Pliers (lineman, needle nose, water pump, arc joint, locking)
- Plumb bob
- Pry bars
- Punch
- Ratchet
- Reamers
- Rubber mallet
- Scratch awl
- Screwdrivers (complete set)
- Shovel
- Sledgehammer
- Socket set (imperial and metric)
- Square
- Striker
- Swage
- T square
- Tap and die sets
- Tin snips (set)
- Torque wrench
- Tri-square
- Utility brushes
- Wire brushes

Power Tools

- Air compressor and accessories
- Band saw
- Bench grinder
- Booster pump
- Chop saw
- Circular saw
- Cordless drills
- Drill press
- Impact tools
- Mini grinder
- Portable band saw (hack saw)
- Powder-actuated tools
- Power drills
- Power hole saw
- Reciprocating saw
- Rotary hammer
- Task lighting equipment

Hoisting, Rigging and Access Tools and Equipment

- Block and tackles
- Come-a-longs and Tirfors™
- Ladders
- Lifting eyes
- Rope/cable
- Scaffolding
- Shackles (varying sizes)
- Slings and chokers
- Snatch blocks
- Wire rope or nylon (synthetic)

Cutting and Joining Equipment

- Copper tube cutter
- Crimpers
- PEX pipe expander (manual and power)
- Half round file
- Flaring tools
- Gas cylinders, and soldering and brazing equipment
- Hand operated oiler
- Mechanical crimper
- Oxy-acetylene welding equipment
- Pipe cutter
- Pipe groover
- Pipe reamer
- Pipe roller
- Pipe stand
- Pipe threader
- Pipe vise
- Plastic tube cutters (set)
- Power vise
- Ratchet cutter (plastic cutters)
- Specialized assembly tools and equipment
- Tube bender
- Tube cutter

Testing and Measuring Equipment

- Builder's level
- Laser level
- Calculator
- Diameter tape
- Differential pressure gauge and sight tube
- Drafting equipment
- Gauges
- Hydrostatic pump and gauge (manual or power)
- Measuring tape and markers
- Multimeter
- Pitot tubes
- Scale ruler

Personal Protective and Safety Equipment

- Eye wash kit
- Face shield
- Fire blanket
- Fire extinguisher
- First aid kit
- Gloves (welding or hot work)
- Hearing protection
- Lock-out devices
- Respiratory mask
- Safety glasses/goggles (welding or hot work)
- Safety harness, lanyard and life line
- Work gloves

Student Tools and Equipment (supplied by student)

Required

- Calculator
- Safety boots
- Hard hat
- Safety glasses

Recommended

- Overalls
- Work gloves

Reference Materials

Required Reference Materials

- All applicable NFPA standards as noted in this Program Outline (current editions)
- Cross Connection Control Training Manual (current edition, acceptable to the certifying body)

Recommended Resources

- IPT's Pipe Trades Handbook, ISBN 978-0-920855-18-8
- IPT's Guide to Blueprint Interpretation, ISBN: 978-0-920855-42-3
- WorkSafeBC Regulations (online), www.worksafebc.com

Suggested Texts/Websites

- Red Seal, www.red-seal.ca
- SkilledTradesBC www.skilledtradesbc.ca
- National Fire Protection Association, www.nfpa.org
- Canadian Automatic Sprinkler Association, www.casa-firesprinkler.org

Instructor Requirements

Occupation Qualification

The instructor must possess:

- Sprinkler Fitter (Sprinkler System Installer) – Provincial Certificate of Qualification or Certificate of Qualification with Red Seal endorsement

Required Work Experience

A minimum of 5 years' experience working in the industry as a Sprinkler Fitter (Sprinkler System Installer) journeyperson after Provincial Certificate of Qualification or Certificate of Qualification with Red Seal endorsement.

Instructional Experience and Education

It is preferred that the instructor also possesses one of the following:

- Provincial (BC) Instructor Diploma or completion of a similar Trainer Training / Instructional Methods program (i.e.: UA Trainer Certificate)
- Bachelor's Degree in Education
- Master's Degree in Education

  AND
- 2 years supervisory or administrative experience
- Experienced user of relevant software
  - Word processing
  - Spreadsheets
  - Presentations

Appendices

Appendix A
Acronyms

AHJ	Authority having jurisdiction
ANSI	American National Standards Institute
CAN/ULC	Canadian Standards for Fire Alarm Systems
CEC	Canadian Electrical Code
CMSA	Control mode specific application
CMTC	Contract material and test certificate
CPVC	Chlorinated polyvinyl chloride
CSA	Canadian Standards Association
ESFR	Early suppression fast response
HAD	Heat-actuated detector
ITM	Inspection, testing and maintenance
MSDS	Material safety data sheets
NBC	National Building Code
NFPA	National Fire Protection Association
NPT	National Pipe Thread Taper
NST	National Standard Thread
OH&S	Occupational Health and Safety
OS&Y	Outside stem and yoke (valve)
PEX	Crosslinked polyethylene
PIV	Post valve indicator
PRV	Pressure regulator valve
PVC	Polyvinyl chloride
QOD	Quick operating device
RP (RPBA)	Reduced pressure backflow assembly
SDS	Safety data sheets
TDG	Transportation of dangerous goods
WHMIS	Workplace Hazardous Materials Information System

Appendix B
Previous Contributors

The Program Outline was prepared with the advice and direction from the Sprinkler System Installer Governance Committee with funding support from SkilledTradesBC. Members included:

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- Dan McKinley
- Tyler Galloway
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