PIP-0100 Tools & Equipment

NOA Reference:

The material covered satisfies in whole or in part, the requirements for National Occupational Analysis:

- Plumber tasks 1, 5 & 6
- Steamfitter-Pipefitter tasks 2 & 3

Description:

This course is designed to give apprentices the knowledge and skills necessary to use and care for the tools of the trade in a safe, efficient and responsible manner. Course material includes:

- hand and power tools, shop and job-site equipment, tools and facilities
- safety practices in the use and care of equipment and tools used in the piping industry
- operation and maintenance of hand and power tools

Prerequisites:

None

Course Outcomes:

Upon completion of this course, the apprentice will be able to:

- develop safety practices in the use and care of tools and equipment used in the piping industry
- select, operate and maintain hand and power tools, equipment and facilities without damage to equipment, operator or to others
- demonstrate understanding of the responsibilities for the care and proper use of tools

Required Knowledge and Skills:

1. Describe general safety requirements for using tools.
   - guarding, shielding when using tools
   - body positioning
   - pinch points

2. Describe the properties of metals used in hand and power tools.
   - tool steels for wrenches
   - tool steels for saws and blades

3. Describe the terminology associated with metals used in hand and power tools.
   - oxidation
   - corrosion
   - tensile strength
   - shear strength

4. Describe measuring tools, their purpose, applications, safe use and care.
   - tapes, rules, scale rules, calipers, micrometers, gauges, straight edges, plumb bobs, squares and levels
   - torque wrench
   - scribers, markers, dividers and compasses

5. Describe hand tools, their purpose, applications, safe use and care.
   - punches, chisels, files and saws
   - twist drills and drill bits
   - hacksaws
   - files
   - chisels
   - hammers
   - pliers

6. Describe the tools and procedures used to perform the following operations.
   - sheet metal cutting
   - drilling and reaming holes
   - bolt cutting

7. Describe threading devices, their purpose, applications, safe use and care.
   - threading tools
   - internal thread
   - external thread
   - tap and drill charts
   - bolt and pipe threads

8. Describe power tools, their purpose, applications, safe use and care.
   - portable power tools
   - threading machines
   - reaming tools

9. Describe grinding tools, their purpose, applications, safe use and care.
   - portable and stationary grinders
   - grinding and cutting wheels

- grinding discs
- grinder dressers
- rotary wire brushes
- speciality flapper wheels
- rotary files

10. Describe drills and their accessories, their purpose, applications, safe use and care.
    - sizes and speed requirements
    - power drilling equipment (hammer and portable drill)
    - cutting fluids
    - clamping devices
    - drill presses
    - portable drills

11. Describe procedures used to cut metals.
    - power operated saws, friction cut-off equipment and shears
    - metal cutting power tools
    - abrasives and blades

12. Describe shop equipment and hydraulic tools, their purpose, applications, safe use and care.
    - jacks
    - shop cranes
    - chain hoists
    - solvent cleaning tanks
    - pullers, drivers and presses

13. Identify the various types of steam cleaners and describe their use.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- use hand and power tools in projects as identified by the instructor.

PIP-0105 Blueprint Reading and Interpretation 1 (Basic/Residential)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber task 8
- Steamfitter-Pipefitter task 5

Description:

This course is designed to give apprentices the knowledge and skills necessary to use information contained in blueprints and other drawings to plan and carry out plumbing installations in standard residential buildings. Course material covers:

- the use of pipe drawings, specifications, bills of materials, drawing instruments and facilities
- orthographic projection, isometrics, dimensioning, interpretation of specifications
- information on locating specific points using dimensions, compass points and elevations

Prerequisites:

None

Course Outcomes:

Upon completion of this course, the apprentice will be able to:

- interpret piping drawings in orthographic and isometric views for residential dwellings
- complete single line sketches from drawings and blueprints
- convert orthographic drawings to isometric drawings
- apply compass and elevations to pipe drawings
- produce simple orthographic sketches

Required Knowledge and Skills:

FUNDAMENTALS OF BLUEPRINT READING

1. Describe the different types of drawings and sketches and their significance and use

in the piping trade.
- orthographic drawings (series of drawings make plan)
- isometric sketches
- single line sketches

2. Explain the importance of and procedures for proper care and handling of drawings.
   - plastic
   - tape edges
   - notes/changes
   - filing/rolling
   - storage

3. Identify and describe the types of drafting equipment, their care and use.
   - scales, rulers
   - triangles
   - drafting tables
   - pencils, erasers
   - graph paper
   - erasing shield
   - sharpener
   - compass, protractor
   - tee square

4. Explain visualization and its associated views.
   - vertical up/down
   - horizontal side/side
   - plan view
   - elevation view
   - front, rear, left, right views
   - farther, nearer

ARCHITECTURAL DRAWINGS SYMBOLS

5. Identify and interpret the common two lines found on a residential blueprint.
   - center line
   - hidden line
   - cutting plane line
   - break line
   - dimension line
   - extension (or witness) line
   - object line
   - leader line

6. Identify and interpret basic architectural symbols.
   - earth
   - concrete
   - block
   - metal
   - structural steel
   - wood
   - gyproc over wood
   - insulation
   - windows, doors

7. Explain the terms “scale” and “dimension”, their use and location on drawings.

8. Identify and interpret the components of a sketch or drawing.
   - title block
   - name
   - address
   - date
   - materials
   - system
   - view
   - measurements
   - orientation
   - north
   - elevation orientation
   - legibility

SKETCHES AND SYMBOLS

9. Identify residential piping fixture symbols.
   - water closet
   - lavatory
   - bathtub
   - shower
   - kitchen sink
   - laundry tub
   - hot water tank
   - water meter

10. Identify residential piping system symbols.
   - piping
   - fittings
   - valves

11. Identify single line sketch symbols.
    - fittings
    - facing viewer
    - facing away
    - horizontal
    - changes in direction
    - valves, unions, reducers

12. Identify and interpret isometric drawing principles.
    - vertical lines
    - angles relating to horizontal
    - floor penetrations

13. Identify and interpret critical roughing in dimensions for residential piping fixtures.
    - from manufactures literature
    - from roughing in books
    - from building codes
    - for barrier free requirements

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- read and interpret plan views to determine the size, location, and construction of:
    - overall building dimensions
    - building drains and sewers, electrical services
    - interior and exterior walls
    - columns and bases
    - doors and windows
    - pipe
    - sleeves
- read and interpret elevation views to determine the construction, elevations and location of exterior and interior features.
    - exterior wall construction (siding, brick, window)
    - interior elevations (fixtures, counters, equipment, appliances)
- read and interpret sections, details and schedules to determine the size, construction, elevations and location of exterior and interior features.
    - elevations and location of exterior and interior features
    - footing, basement, first and second floors
    - height of stair landings, ceilings
    - ceiling, wall and door-type and construction

    - size and thickness of walls, columns, bases, etc.
- plan a residential piping installation from information contained within construction drawings.
    - piping fixtures, systems and symbols
    - types of fixtures, piping, valves and fittings
    - make isometric sketches
    - compile material lists

PIP-1110 Blueprint Reading and Interpretation 2 (Advanced Residential/Commercial)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis:

- Plumber tasks 7, 8 & 9
- Steamfitter-Pipefitter task 5

Description:

This course is designed to give apprentices the knowledge and skills necessary to use information contained in blueprints and other drawings to plan and carry out plumbing and Pipefitting installations in larger residential and commercial buildings. Course material covers:

- the use of pipe drawings, specifications, bills of materials, drawing instruments and facilities
- orthographic pipe projection, isometrics, isometric dimensioning, interpretation of pipe specifications
- welding and heating symbols
- information on locating specific points using grid lines, compass points and elevations

Prerequisites:

PIP-0100, 0105,1135, 1140

Course Outcomes:

Upon completion of this course, the apprentice will be able to:

- interpret piping drawings in both orthographic and isometric views for residential/commercial buildings
- complete single line sketches from drawings and blueprints
- convert orthographic drawings to isometrics drawings
- apply compass and elevations to pipe drawings
- perform orthographic sketches
- interpret architectural drawings

Required Knowledge and Skills:

ARCHITECTURAL DRAWINGS AND SYMBOLS

1. Explain the different methods used to study a set of plans, their purpose and applications.
   - numerical
   - large elements
   - tradesperson's view

2. Describe divisions, their content, relationship and numbering systems.
   - architectural
   - mechanical
   - electrical

3. Describe plans, their content and use in job planning.
   - plot (site)
   - foundation
   - basement, first, second (subsequent) floor plans
   - exterior elevations
   - sections, details
   - reflected ceiling drawings
   - room finish schedules

4. Identify and describe the various features found on architectural drawings.
   - grid lines
   - exploded views
   - sections
   - details
   - finish schedule
   - page references
   - elevations
   - architectural symbols

5. Explain the procedures used to determine accurate dimensions from a drawing, their purpose and importance.
   - how measurements are indicated (engineer vs architect)
   - origin and end
   - wall locations
   - pipe penetrations use of scaling

6. Describe the procedures used to submit specifications, their purpose and importance.

SKETCHES AND SYMBOLS

7. Identify and describe the various piping fixture symbols found on a set of commercial drawings.
   - wall hung toilet
   - wall hung lavatory
   - wall hung urinal
   - janitors sink
   - triple compartment sink
   - drinking fountain
   - grease interceptor
   - bidets
   - fixture carriers

8. Identify commercial piping system symbols and explain their importance and use.
   - piping
   - building sewer
   - building drain
   - soil and waste stacks
   - fixture drains and branches
   - venting
   - domestic hot
   - cold and re-circulation lines
   - storm building drains and sewers
   - compressed air
   - trap priming
   - fittings (elbows, wye's, tees, cleanouts, reducers, unions, flanges)
   - valves (ball, check, gate, globe, backwater, pressure reducing, trap primer)
   - hangers and supports (clevis, roller, trapeze, spring)
   - heating (piping, heating water supply, water return, anchors, guides)
   - heating equipment (boilers, oil tanks, radiation, exchangers, expansion tanks, thermometers, pressure gauges, auto air vents, flex connections/loops)
   - heating valves (circuit setters, flow control, pressure relief, control, 3-way)

9. Identify welding symbols and explain their use.
   - description of symbols
   - symbol construction techniques
   - designated letters
   - multiple reference lines
   - identification of electrodes

10. Identify and interpret commercial ventilation symbols, and explain their use.
   - duct work
   - fans and equipment
   - fire dampers and access doors

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- read and Interpret plan views.
- read and interpret elevation views.
- identify and interpret floor plans, sections and details, specifications.
- read and interpret plans and specifications.
- perform isometric sketching.
- perform single line sketches.

PIP-1115 Blueprint Reading & Interpretation 3 (Commercial/Industrial)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis.

- Plumber tasks 7, 8, 9 & 10
- Steamfitter-Pipefitter tasks 5, 6, 7, 8, & 9

Description:

This course is designed to give apprentices the knowledge and skills necessary to use information contained in blueprints and other drawings to plan and carry out plumbing and pipefitting installations in large commercial/industrial buildings. Course material covers:

- architectural, mechanical and electrical drawings, pipe drawings, specifications, bills of materials, drawing instruments and facilities
- orthographic projection, isometrics, dimensioning, interpretation and specifications
- mechanical and electrical symbols
- information on locating specific points using grid lines, compass points and elevations
- builders level/transit

Prerequisites:

PIP-0100, 0105, 1110, 1135, 1140, 1150

Course Outcomes:

Upon completion of this course, the apprentice will be able to:

- interpret industrial piping drawings in both orthographic and isometric and sketch views
- interpret architectural drawings and specifications
- complete single line sketches from drawings and blueprints
- convert orthographic pipe drawings to isometrics pipe drawings
- apply compass and elevations to pipe drawings
- compile as-built, design built and shop drawings
- demonstrate understanding of system identification procedures
- determine measurements and elevations using a builders level
- compile materials lists from sketches

Required Knowledge and Skills:

ARCHITECTURAL DRAWINGS AND SYMBOLS

1. Identify and explain the types of plans and their purpose and use for commercial projects.
   - plot (site)
   - foundation
   - floor plans
   - elevations
   - sections
   - details
   - reflected ceiling drawings
   - room finish schedules

2. Describe the features contained in commercial drawings, their importance and use.
   - grid lines
   - exploded views
   - sections
   - details
   - finish schedules
   - page references
   - elevations
   - architectural symbols

3. Describe the sequencing and procedures used to plan materials for hangers, sleeves, fixture carriers.
   - floor/slab construction
   - wall construction
   - structural supports

4. Identify and explain the various architectural and electrical symbols and abbreviations.

5. Identify and explain architectural specifications.
   - breakdown of divisions
   - trade responsibilities
   - materials

SKETCHES

6. Describe various forms of computer aided drafting, their use, importance and their advantages.

7. Identify and describe the various piping related symbols found in a set of commercial or institutional drawings.
   - fixtures/piping/valve

- equipment

8. Identify and describe the various heating related symbols found in a set of commercial or institutional drawings.
   - heating and cooling systems
   - heating equipment
   - heating valves
   - fuel oil system

9. Identify and describe the following piping related systems.
   - kitchen equipment
   - medical gas
   - compressed air

10. Identify and describe other related systems and their components found on an institutional/commercial project.
   - ventilation
   - electrical
   - fire protection
   - control systems
   - pneumatic tube

11. Describe the purpose and use of the following information systems.
   - as-built drawings
   - shop drawings

12. Identify and explain the methods and significance of providing system identification.
   - colour coding
   - pipe identification
   - valve tags, tabs, charts
   - equipment identification

13. Explain the use of piping and heating detail drawings.

14. Identify and describe various industrial piping abbreviations.
   - ANSI, ASME, ASTM
   - BOP, BW
   - CPLG, CONC
   - ECC, ELEV
   - FOB, FOT
   - RED
   - SCH
   - TOS, SMLS, etc.

15. Identify and describe various industrial piping symbols.

16. Identify and explain information contained on Industrial drawings.
    - schematic and assembly drawings
    - views, feeder maps, etc.
    - fabrication sequence
    - list cut lengths of materials
    - lines and fillets on working drawings
    - dimension holes, cylinders, circles and angles

17. Explain the purpose and use of:
    - (P&ID) process and instrument drawings
    - spool sheets
    - flow diagrams
    - industrial piping drawings

18. Identify and explain industrial piping drawings.
    - plot plans, pipe drawing index, isometric call outs, pipe line list, etc.
    - schematic drawings, flow diagrams, isometric drawings, spool sheets, etc.

19. Describe the procedures used to find locations using compass points and elevations.

20. Identify and explain Industrial electrical drawings.
    - schematic
    - point to point diagrams
    - flow diagrams
    - wireless diagrams
    - highway diagrams
    - ladder diagrams

21. Explain the procedures used to compile material lists from drawings.

BUILDER'S LEVEL/TRANSIT

22. Describe the parts of a builders level/transit and their function.
    - telescope
    - level bubbles
    - leveling screws
    - eye piece
    - focusing
    - locking screws
    - vernier scale
    - protective lens

23. Describe the function and procedures for use of the extension rod.
    - height of rod
    - holding the rod
    - markings on rod

- readings on rod

24. Explain leveling terms.
    - line of sight
    - instrument location
    - station
    - bench mark
    - height of instrument
    - back sight
    - fore sight
    - turning point

25. Describe the procedures used to determine measurements and elevations using a builders level.

26. Describe the procedures used to lay out pipe lines and grades with builders level.
    - turn angle
    - name station
    - locate and number stations
    - set up grade stakes
    - mark grade stakes

27. Describe the vernier scale and procedures for its use.
    - vertical and horizontal vernier
    - parts of an angle
    - turning an angle

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- set up and use builder's level.
    - determine measurements and elevations using back sights and fore sights
    - find a job sight bench mark
    - demonstrate the ability to turn angles
- calculate math elevations at stations.

PIP-1120 Rigging

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber task 6
- Steamfitter-Pipefitter task 15

Description:

This course is designed to introduce equipment and safe procedures used in erecting and securing rigging equipment according to manufacturers guidelines. Course material covers:

- safety requirements
- rigging equipment and safety equipment
- installation, testing and maintenance of rigging
- types of ropes, types of knots, bends, hitches, splicing rope
- slings, scaffolds and ladders.

Prerequisites:

PIP-0100

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- recognize the limitations of equipment used for rigging
- ensure safe operation of slings, cables and cranes
- select appropriate equipment for the job, using rigging charts and manuals as well as rule of thumb methods

Required Knowledge and Skills:

1. List the Occupational Health and Safety Regulations for rigging.

2. Describe responsibilities and liabilities in the use of rigging, lifting and hoisting equipment.

3. Describe the different types of ropes, their care, inspection and related safety.
   - considerations for use

- natural fibre, synthetic fibre

4. Describe the different kinds of knots, hitches and bends and their applications.

5. Explain angle considerations when using rigging.
   - rigging charts
   - rule of thumb formulas
   - compensation for angles in lifting of loads

6. Describe the different types of wire rope and accessories, their care, inspection and safety considerations for use.
   - construction
   - clips and attachments
   - slings and end rigging
   - measurement
   - clamps and rigging
   - splicing

7. Describe synthetic sling types, their characteristics, applications and limitations.
   - polyethylene slings
   - polyester slings
   - nylon slings
   - mylar
   - kevlar

8. Describe chain slings, their characteristics, applications and limitations.

9. Describe the different types of scaffolds.
   - tube and clamp
   - manufactured platforms and scaffolding
   - suspended scaffolding
   - swing stage

10. List safety rules for erecting and working on scaffolding.
    - kickplates
    - braces
    - ties
    - planking
    - permits
    - tagging

11. Describe special problems of rolling and suspended scaffolding and safety guidelines for their use.

12. Describe the various types of ladders, their applications and safety factors to be considered when using ladders.

13. Describe the proper procedures and equipment for handling objects with rigging equipment.

14. Describe jacks, their applications and procedures for use.

15. Describe procedures for safe use of elevators.

16. Identify hand signals.

17. Describe the various types of overhead cranes and procedures for working safely around them.
    - mobile
    - boom
    - overhead

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- select and tie appropriate knots and hitches for a variety of tasks.
    - figure 8
    - reef
    - bowline
    - catspaw
    - midshipman's hitch
    - timber hitch (and half-hitch)
    - clove hitch
    - rolling hitch
- Use lifting and hoisting equipment safely.
- Use wire and/or rope slings to lift pipes and/or equipment.

PIP-1125 Introduction to Fuel Welding & Cutting

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 6 & 27
- Steamfitter-Pipefitter task 14

Description:

This course is designed to develop the skills to competently assemble, operate, adjust, disassemble and store fuel welding and cutting equipment. Course material covers:

- equipment and set up
- preparing, cutting and welding metal
- shut down, disassembly and storage of equipment.
- safety requirements, cylinder pressures, combustion and flames, storage and transporting of cylinders and types of regulators.

Prerequisites:

PIP-0100

Course Outcome:

Upon successful completion of this course, the apprentice will be able to:

- use fuel cutting and welding equipment properly and safely in the workplace

Required Knowledge and Skills:

SAFETY AND EQUIPMENT

1. Describe the various types of heating equipment, their applications and procedures for use.
   - air-propane equipment
   - air-acetylene system
   - oxy-acetylene system
   - accessories and related equipment
   - lighting and adjusting operations

2. Describe the possible hazards of using oxy-acetylene equipment and procedures.
   - burns
   - fires
   - explosions
   - injuries
   - fumes

3. Describe safety practices for use in welding, brazing and cutting operations.
   - clothing
   - location
   - protective equipment

4. Describe oxy-fuel equipment and accessories, their components, purpose and characteristics.
   - cylinders
   - gas
   - regulators
   - check valve
   - gauges
   - hoses, clamps, y-connecters, coupler-T
   - fibre washers
   - equipment wrench
   - torches
   - mixer
   - tips
   - cutting attachment

5. Describe the use and care of oxygen cylinders.
   - characteristics of oxygen
   - cylinder components and capacity
   - storage and safety considerations

6. Describe the use and care of acetylene fuel cylinders.
   - characteristics of acetylene
   - cylinder components and capacity
   - storage and safety considerations

7. Describe the various types of cylinder trucks and lifting cages.

8. Describe lighting procedures and types of flames produced by oxy-acetylene equipment.

9. Describe the procedures used for testing equipment for leaks.

BRAZING

10. Describe the principles of the brazing process and the differences between welding and brazing.

11. Describe fluxes, their applications and procedures for use.
    - soldering, brazing fluxes
    - components and classifications of brazing fluxes

12. Describe braze welding processes as applied to various metals.

13. Describe the flame adjustment for brazing of various materials.

14. Describe the considerations, preparation, process and precautions used to produce various types of joints.
    - face feed brazed joints
    - pre-inserted ring joints

15. Describe the procedures used to repair brazed joints.
    - joint disassembly
    - re-use of fitting and pipe
    - repair of joints
    - testing and inspection

WELDING

16. Describe the sequencing and procedures used in oxy-fuel welding.

17. Describe the types of metals that are suitable for the welding process.

18. Describe the various types of filler metals, their classification and procedures for use.

19. Describe the procedures used in joint preparation.
    - analysis of procedures
    - measurement
    - cutting tube and pipe
    - pre-cleaning
    - fluxing
    - assembly
    - specific instructions for heating and flowing the alloy for a variety of joints

20. Describe the processes and procedures used in joint assembly.

CUTTING

21. List metals that can be cut using oxy-fuel equipment.

22. Describe the various styles and designs of standard cutting torches.

23. Describe the various cutting tips, their care and maintenance.
    - sizes, styles and indexing
    - accessories and tip cleaners

24. Describe the various types of cutting flames and procedures used for flame adjustment.
    - oxidizing
    - carburizing
    - neutral

25. Describe cutting procedures.
    - free hand
    - straight edge

26. Describe common cutting faults, their causes and remedies.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- cut and weld an angle bracket to given measurements and tolerances.
- braze weld a copper tubing project to given measurements and tolerances.

PIP-1130 Introduction to Electric Welding & Cutting

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 6 & 27
- Steamfitting/Pipefitting task 14

Description:

This course is designed to introduce the participant to the electric welding and cutting process and the codes and standards that apply. Material presented includes:

- the use of personal protective equipment and accessories, materials and supplies.
- set up of equipment, preparing and welding and cutting metal, shutting down equipment and testing the weld.
- basic electricity, types of electrodes, types of welding machines, joint design and weld faults and destructive and non-destructive testing procedures.

Prerequisites:

PIP-0100, 1125

Course Outcome:

Upon successful completion of this course, the apprentice will be able to:

- use electrically operated welding and cutting equipment to complete work on various materials

Required Knowledge and Skills:

1. Explain the terminology associated with electric welding methods.

2. Describe the shielded metal arc welding process and its applications.

3. Describe the advantages and disadvantages of arc welding processes.
   - GMAW (MIG)
   - GTAW (TIG)
   - SMAW
   - Fluxcore

- SUB ARC
- Orbital welding

4. Describe electric welding equipment and its components.
   - AC transformers
   - AC/DC rectifiers
   - DC generators
   - engine drive (gasoline, diesel) sources

5. Describe the basic classifications and applications of electrodes.

6. Describe the preparation for electric welding operations.
   - electrode selection
   - current
   - polarity settings
   - arc length
   - travel speed
   - electrode angles
   - work and travel angles for weld metal deposition

7. Describe the five basic joint configurations.

8. Describe the safety techniques used in electric welding processes.

9. Describe the equipment used for arc welding.

10. Describe the procedures and sequencing used in the arc welding process.

11. Describe the characteristics of hot and cold rolled steel.

12. Describe carbon steel electrodes.
   - classification of mild steel and low alloy steel electrodes
   - operator protection, basic machine and circuit theory
   - AC & DC
   - Arc Blow
   - duty cycle
   - rated amperage
   - thawing pipes
   - striking and maintaining arc
   - stringer and weave beads

13. Explain the procedure used for welding in a flat position with SMAW.

14. Describe the plasma cutter, its applications and use.
   - plasma theory of operation
   - metals that can be cut

- procedures for use

15. Explain carbon arc gouging.
    - process gouging
    - types of metals that can be cut
    - heat treatment procedures

16. Describe electrode types for special applications.
    - mild steel and low alloy electrodes
    - functions of flux coating
    - electrode identification
    - electrode prefix and suffix lettering system
    - identification of parent metal
    - welding position
    - power source
    - joint design and fit up
    - electrode diameter
    - metal properties
    - production efficiency
    - low hydrogen electrode
    - AWS and CSA electrode codes.

17. Explain stress relief of piping materials.
    - arc strikes and their effects
    - grain structure of piping materials before and after welding
    - methods used to normalize materials after welding
    - preheat/postheat of materials.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- perform different basic welding projects as identified by the instructor.
- weld an angle bracket to given measurements and tolerances.

PIP-1135 Pipe, Fittings & Piping Assembly 1

NOA Reference:

The material covered satisfies in whole or in part, the requirements for National Occupational Analysis

- Plumber tasks 8, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 26, 29 & 34
- Steamfitter-Pipefitter tasks 11, 13, 14 & 15

Description:

This course in piping fundamentals is designed to give apprentices the knowledge and skills necessary for assembling piping systems with respect to various codes and standards and to practice safety in a working environment. Course material covers:

- an overview of piping materials used in the industry in the past as well as modern applications
- information on the types and applications of materials currently used in the manufacture of pipe for the piping industry
- procedures used for the joining of piping and component parts using various assembly methods.

Prerequisites:

PIP-0100

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- select materials
- use hand and power tools to assemble various types of piping used in the industry
- carry out work in compliance with codes and standards

Required Knowledge and Skills:

INTRODUCTION TO PIPING SYSTEMS

1. Identify the types of piping and tubing systems.
   - potable/non-potable water supply
   - sanitary drainage, waste and vent systems
   - storm drainage systems

- heating systems
- sprinkler systems
- gas systems(fuel, medical)
- specialties (high purity water, chemical, swimming pool, irrigation, septic)

2. State the types of common piping materials and list their characteristics and forming methods.

3. Describe the procedures used for sizing pipe and tubing.
   - dimensions
   - lengths
   - wall thickness/schedule

4. Describe the terms ferrous and non-ferrous, their relationship with and significance to the trade.

5. Describe the forces that act on piping systems.
   - thermal expansion and contraction
   - weight
   - electrolysis
   - friction loss
   - flow direction change

6. Describe the types of hangers and their relationship to the type of piping used.

7. Describe the types of sealants used in the trade and the applications of each.
   - thread compounds
   - gaskets
   - packing
   - cements/glue

8. Describe the requirements for testing piping systems and procedures used to carry out testing.
   - air
   - water
   - smoke
   - flow, ball, peppermint

9. Calculate the perimeter and areas of:
   - squares
   - rectangles
   - triangles
   - circles

10. Calculate the volume of:
    - cubes
    - rectangular prisms and cylinders

11. Explain the metric system and its use in the building trades.
    - length
    - area
    - volume
    - temperature
    - pressure
    - mass

STEEL PIPE AND FITTINGS

12. List the properties and applications of steel pipe and fittings.

13. Describe the methods and colors used to identify the associated systems.
    - heating systems
    - cooling systems
    - drainage, waste and vent systems
    - compressed air systems
    - fuel oil/gas systems
    - steam, humidification systems
    - industrial, marine, food processing
    - pipe schedules

14. List the types of ferrous piping, their characteristics and applications.
    - steel
    - galvanized
    - stainless
    - cast iron

15. List the information required before ordering steel pipe.
    - material (steel, galvanized, stainless)
    - size (diameter, length, standard lengths)
    - schedule (wall thickness or grade)
    - characteristics (welder/seamless)
    - end finishes (plain end, thread, grooved, beveled)

16. Describe the tools and methods used for cutting steel, galvanized and stainless steel pipe.
    - pipe cutters, reamers
    - cut-off saw
    - oxy/acetylene pipe beveler
    - plasma arc cutter

17. Identify and describe the methods of joining steel, galvanized and stainless steel pipe.
    - threading and grooving
    - welding
    - flanging
    - press-fit

18. Identify and describe the tools used to join steel, galvanized and stainless steel pipe.
    - hand and power threaders
    - hand and power roll groovers
    - cut groovers
    - oxy/acetylene, electric, Mig/tig welding systems
    - press-fit crimper
    - vice, wrenches

19. Identify and describe the types of fittings used for joining steel, galvanized and stainless steel pipe.
    - terminology
    - types
    - parts
    - abbreviations

20. Identify and describe the tools and procedures used to handle, support and fasten steel pipe and fittings.
    - codes
    - specifications
    - grade
    - components

21. Describe an angle and its parts.
    - vertex, degrees, letters

22. Describe a circle and its parts.
    - centre
    - circumference
    - diameter
    - radius
    - cord
    - arc
    - concentric and eccentric circle

23. Describe pipe measurement terms and their use.
    - end to end
    - end to centre
    - centre to centre
    - back to back
    - centre to back

- centre to throat
- face to face
- overall

24. Calculate piping measurements.
    - run and branch
    - fitting allowance (F.A., C.F., T.M.)

25. Calculate piping measurements with 45 degree fittings.
    - diagonal
    - offset
    - run
    - factors

26. Calculate using pipe lengths.
    - grade
    - drop
    - run

CAST IRON PIPE AND FITTINGS

27. List the properties and applications of cast iron pipe and fittings.
    - drainage
    - waste
    - vent
    - potable water

28. Describe the methods and color used to identify the associated systems.

29. Identify the systems and criteria used in referencing and ordering cast iron soil pipe.
    - diameter
    - length
    - end finishes
    - hub, no-hub

30. List the information required before ordering cast iron water pipe.
    - material (ductile, duriron)
    - size - diameter
    - length
    - schedule - wall thickness, schedule or grade
    - end finishes - plain end, cut grooved

31. Explain the tools and procedures used to cut cast iron soil pipe.
    - snap cutters
    - cut off saw
    - chop saw

- hacksaw hammer/chisel

32. Explain the tools and procedures used to cut ductile and duriron pipe.
    - cut off saw
    - chop saw

33. Describe the tools used to join cast iron soil pipe, ductile and duriron pipe.
    - bi-seal puller
    - torque and hand wrenches

34. Explain the methods of joining cast iron soil pipe, ductile and duriron pipe.
    - lead and oakum
    - mechanical joint
    - bi-seal

35. Identify and describe the fittings used for joining cast iron soil pipe, ductile and duriron pipe.
    - terminology
    - types
    - parts
    - abbreviations

36. Identify and explain the tools and procedures used to hang, support, and fasten cast iron pipe and fittings.
    - plumbing codes
    - specifications
    - grade
    - components

COPPER PIPE AND FITTINGS

37. List the types of non ferrous piping and discuss their uses.
    - copper
    - brass
    - aluminum
    - lead

38. List the properties and applications of copper pipe and fittings, and describe the methods and colors used to identify the following associated systems:
    - underground water service
    - domestic hot and cold water systems
    - drainage, waste and vent systems
    - hot water heating systems
    - medical gas systems
    - refrigeration systems

39. Identify the systems and criteria that will be used in referencing and ordering copper tube and tubing.
    - size
    - I.D.O.D. dimension standards
    - length
    - type- H, K, L, M, DWV, Medical Gas, ACR, GP
    - color coding (white, green, blue, red, yellow)

40. Describe the tools and methods used to cut copper pipe.
    - tube cutter
    - reamer
    - cut off saw
    - chop saw
    - hacksaw

41. Describe the methods and tools used to join copper pipe.
    - solder/braze
    - compression
    - grooved
    - swaged/flare
    - T-drill

42. Describe the tools and procedures used for soldering, bending and annealing copper pipe and fittings.

43. Identify and describe the types of fittings used for joining copper pipe.
    - terminology
    - types
    - parts
    - abbreviations

44. Identify and describe the methods and tools used to hang, support, and fasten codes.
    - specifications
    - grade
    - components

PLASTIC PIPE AND FITTINGS

45. Describe the difference between thermoplastics and thermosetting plastics. List the types of plastic piping, their properties and applications.
    - ABS (Acrylonitrile-Butadiene-Styrene)
    - PVC(Chlorinated Polyvinyl Chloride)
    - PB (Polybutylene)
    - PE (Polyethylene)
    - PP (Polypropylene)
    - PVC (Polyvinyl Chloride)

- PEX (with/without oxygen barrier)

46. Describe the coding system used to identify plastic pipe and fittings.

47. Describe the tools and explain the methods used to cut the various types of plastic pipe.
    - tube cutter
    - file
    - chop saw
    - hacksaw
    - handsaw

48. Describe the tools and explain the methods used to join the various types of plastic pipe.
    - solvent weld
    - fusion weld
    - thread
    - compression
    - flare
    - mechanical joint
    - insert

49. Identify and describe the types of fittings used for joining the various types of plastic pipe.
    - terminology
    - types
    - parts
    - abbreviations

50. Describe the applications and procedures for use of PEX pipe and fittings.
    - coils
    - straight lengths
    - manifolds
    - support brackets
    - elbows
    - tee
    - coupling
    - adaptors
    - plugs
    - rings
    - compression fittings
    - tube rails
    - bend supports

51. Describe the PEX tube uncoiler, its applications and procedure for use.

52. Describe the tools and methods used to hang, support, and fasten plastic pipe and fittings.
    - fire barrier penetration
    - plumbing codes
    - specifications
    - grade
    - components

BRASS PIPE AND FITTINGS

53. List the properties and applications of brass pipe and fittings.

54. Describe the types and sizes of brass pipe, its advantages and disadvantages.

55. Describe the procedures and methods used to cut brass pipe.
    - pipe cutters, reamers
    - cut-off saw
    - hacksaw

56. Describe the methods and tools used to thread brass pipe.

57. Identify and explain the types of fittings used for joining brass pipe.
    - terminology
    - types
    - parts
    - abbreviations

58. Describe the procedure for calculating fitting allowance for brass pipe fittings.
    - elbows
    - tee’s
    - other

59. Identify and explain the methods and tools used to hang, support, and fasten brass pipe and fittings.
    - codes
    - specifications
    - grade
    - components

PIPING VALVES

60. Describe the materials and service ratings for valves.

61. Explain valve terminology.

62. Describe the principal types of valves, their purpose, construction, operation and

applications.

- gate
- globe
- ball/plug
- butterfly (gear or lever)
- check, temperature / pressure relief, pressure reducing valves
- float operated valves

63. Describe valve installation procedures.
    - position
    - location
    - accessibility
    - installation methods (screwed, welded, sweated, etc.)

64. Describe the design, operation and components of the following:
    - solid wedge disc gate valve
    - split wedge disc gate valve
    - plug valve
    - conventional disc globe valve
    - composition disc globe valve
    - angle valve
    - ball valve
    - swing check valve
    - lift check valve
    - non-freeze wall hydrant
    - radian valves

65. Describe the types, construction and operation of control valves.
    - two-way
    - three-way
    - motor operated

66. Describe the care and maintenance of valves.
    - disassembly/reassembly
    - replacement of parts
    - re-packing
    - tools required

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- join steel pipe by threading.
    - measure
    - mark
    - cut
    - ream
    - thread
    - seal
    - assemble
    - test
- maintain and repair steel, galvanized and stainless steel pipe systems.
    - repair leaks
    - remove and replace fittings
- maintain and repair copper pipe systems.
    - remove drain blockages
    - repair leaks
    - cut out and replace fittings
- join PEX pipe and fitting systems.
    - measure
    - mark
    - cut
    - ream
    - assemble
    - test
- join brass pipe by threading.
- select and install pipe and fittings according to specific applications and codes.
- select and install valves according to specific applications and codes.

PIP-1140 Pipe, Fittings & Piping Assembly 2

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 35 & 36
- Steamfitting/Pipefitting tasks 11, 13, 14 & 15

Description:

This course in piping fundamentals is designed to give apprentices the knowledge and skills necessary for assembling piping systems with respect to various codes and standards and to practice safety in a working environment. Course material covers:

- valves
- information on the types and applications of materials currently used in the manufacture of pipe for the piping industry
- procedures used for the joining of piping and component parts using various assembly methods.

Prerequisites:

PIP-0100, 1135

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- select materials
- use hand and power tools to assemble various types of piping used in the industry
- carry out work in compliance with codes and standards

Required Knowledge and Skills:

HISTORIC PIPING

1. List the types of other plumbing related piping, their properties and discuss their uses.
    - lead
    - fiberglass
    - bituminized fiber
    - plastic lined metal

- vitrified clay
- aluminum DWV
- asbestos cement

2. Describe the sizes of fiberglass pipe. Describe the procedures used to cut and join fiberglass pipe.

3. Describe the fittings used with fiberglass pipe and their applications.

4. Describe the characteristics and history of lead pipe.
   - measuring sheet lead
   - forming tools
   - thickness of sheet lead and lead stubs
   - repair lead stub and WC floor flange
   - lead vent flashing

5. Describe the procedure used to repair lead waste pipe.
   - weight of lead
   - tools
   - water closet stub
   - lead to copper adapter fitting
   - wiping lead joints
   - cleaning
   - patching
   - soldering
   - testing

NON-METALLIC PIPING

6. List the types of non metallic piping, their properties and discuss their uses.
   - glass
   - concrete
   - fibreglass

7. Explain the tools and methods used to cut and join glass pipe.

8. Identify and explain the types of fittings used for joining glass pipe.
   - terminology
   - types
   - parts
   - abbreviations

9. Describe the procedure for calculating fitting allowance for glass pipe fittings.
   - elbows
   - tees

10. Identify and explain the methods and tools used to hang, support, and fasten glass pipe and fittings.
    - codes
    - specifications
    - grade
    - components

COMMERCIAL / INDUSTRIAL / SPECIALTY VALVES

11. List the principal types of industrial valves and their operation.
    - gate
    - globe
    - ball/plug
    - butterfly
    - check
    - angle valve
    - temperature/pressure relief
    - pressure reducing valves
    - float operated valves

12. List the types of valves unique to commercial/industrial construction.
    - cylinder operated
    - motor operated
    - gear operated

13. Describe large valve installation procedures.
    - position
    - location
    - accessibility
    - installation methods

14. Describe the types, construction and operation of control valves.
    - two-way
    - three-way
    - motor operated

15. Describe the specialty control valves and equipment used in water distribution.
    - blended water equipment
    - manual mixing valves
    - pressure balancing valves
    - tempered water equipment
    - thermostatic mixing valves

VALVE MAINTENANCE

16. Describe common service problems associated with valves and specialty control valves.

17. Describe the tools and procedures used to disassemble and reassemble valves.

18. Identify and interpret sources of information regarding valve service and repair.
    - codes
    - system specifications
    - manufacturer's literature

19. Describe techniques and procedures to service and repair valves.
    repacking
    grinding
    lapping
    required tools

20. Describe requirements and procedures used to test valves.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- disassemble and reassemble different types of valves.
    - repack valves.

PIP-1150 Hydronic Heating 1

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 21 & 24
- Steamfitting/Pipefitting tasks 13, 14, 15, 23 & 24

Description:

This course is designed to give apprentices the knowledge and skills necessary for the installation, operation, testing and maintenance of piping and heating control systems with respect to various codes and standards. Course material covers:

- hot water heating systems
- control systems and component parts
- low pressure hot water boiler systems

Prerequisites:

PIP-0100, 1110, 1120, 1125, 1130, 1135, 1140

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate understanding of the operation of hot water boilers and heating systems, their component parts and control systems

Required Knowledge and Skills:

FORCED FLOW HEATING

1. Identify and interpret hydronic heating schematic symbols and terms that apply to hydronic heating.

2. Describe heating systems, their components and operation.
   - boiler components and boiler design
   - boiler combustion process
   - heating system usage and design
   - radiant panel heating systems and in-floor radiant heating
   - snow melting systems

- heat pumps
- gravity systems
- solar heating systems
- purging

3. Describe boiler accessories and their functions.
   - burner installation
   - wiring the boiler
   - ASME relief valve
   - boiler fittings
   - tank fittings and valves
   - airtrol system
   - air venting specialties
   - boiler code requirements

4. Describe compression tanks and air control devices.
   - installation practices
   - air scoops

5. Describe circulating pumps, their components and function.
   - circulating pumps and low head pumps

6. Describe diversion fittings, their purpose and function.
   - venturi and super-venturi fittings (monoflo tees)
   - single main systems

7. Describe zone valves, their purpose and operation.
   - electric motor
   - orifice seat sizes
   - end switch
   - thermostats
   - three-way valves

8. Describe hot water controls and accessories, their purpose and operation.
   - thermostats
   - motorized valves or zone control valves
   - aquastat
   - pressure drop
   - balancing a heating system

9. Describe various types of piping arrangements used with heating systems.
   - piping layout and system components
   - piping systems
   - types and rating of heat distributing units

10. Describe the factors that affect pipe sizing and piping arrangement.

- equivalent direct radiation
- piping systems
- changes in pipe size
- heat loss calculations

11. Describe the types of heat transfer equipment, their characteristics, piping arrangements and installation procedures.
    - heating units
    - radiators
    - baseboard heating
    - wall fin
    - convectors
    - pipe coils
    - unit heaters horizontal and vertical unit heaters

12. Describe techniques used for troubleshooting hot water heating systems.

13. Describe equipment used for erecting boilers.
    - dog and clamps
    - tie rods
    - corrugated expansion washers

14. Describe the construction of modern package boilers.
    - components
    - section assemblies
    - top clean out openings
    - integral flue gas collector and smoke collar
    - tank-less water heaters

15. Describe the installation of packaged boilers.
    - general erection instructions
    - boiler foundations
    - step by step procedures

16. Describe zone control systems, their types, characteristics and operation.

17. Describe thermostats, the types, their characteristics and controls.
    - differential
    - adjustment
    - sensitivity
    - classification
    - installation procedures

18. Describe pressure controls, the types and their operation.
    - location
    - mounting

19. Describe feedwater treatment systems.
    - chemicals used in boiler feedwater

RADIANT FLOOR HEATING

20. Describe the principles and operating characteristics of radiant floor heating.

21. Describe types of tubing and their use for radiant infloor hydronic systems.
    - polymer piping materials
    - PEX tubing
    - Poly Butylene tubing
    - rubber-based tubing
    - cross-linking
    - temperatures and pressures
    - coil lengths
    - sizes
    - oxygen diffusion

22. Describe types of mixing valves, their operation and applications.
    - purpose
    - water temperatures
    - three-port mixing valve
    - four-port mixing valve
    - thermostatic mixing valves
    - motorized actuators
    - blending water temperatures

23. Describe slab-on-grade infloor heating, preparation and installation procedures.
    - tie spacing
    - wire mesh
    - plastic tracks
    - spacing tubing
    - tubing depth
    - insulation
    - installation procedure
    - preparation of floor

24. Describe location of the manifold stations and tubing lay out.
    - mark out on plan
    - studded wall cavities
    - use of template block
    - centers on block
    - plastic bed supports
    - label circuits
    - pressure test

- control joints

25. Describe the procedures used to prepare a drawing for the layout plan.

26. Describe system piping and control options.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- compile materials lists.
- nstall a three zone series hydronic heating system for a single family residence and pressure test.
- provide a complete list of material for three zone series system.
- layout and draw in isometric and complete three zone series loop hydronic heating system for a single family residence.
- install a complete three zone residential heating boiler, all components, one series loop and pressure test.
- draw an elevation view of an above ground oil storage tank, all attached piping and accessories.

PIP-1155 Hydronic Heating 2

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 21, 22, 23 & 24
- Steamfitting/Pipefitting tasks 13, 14, 15, 23 & 24

Description:

This course is designed to give apprentices the knowledge and skills necessary for the installation, operation, testing and maintenance of piping and heating control systems with respect to various codes and standards. Course material covers:

- commercial hot water heating systems
- multi-zoning

Prerequisites:

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140, 1150

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate understanding of the operation of commercial heating systems, their associated piping and control systems
- demonstrate understanding of the operation and controls of multi-zone hydronic heating systems

Required Knowledge and Skills:

1. Describe multi-zone hot water heating systems, their operating characteristics and components.

2. Describe conventional methods of zone control.
   - zone control using valves (two-way and three-way)
   - zone control using pumps

3. Describe zone control with primary and secondary pumping.
   - operating principles
   - advantages

- primary and secondary pumping
- controlling secondary zones
- intermittent and continuous pump operation
- typical control arrangements
- heating-cooling system

4. Describe the composition and layout of the primary circuit for given applications.
   - one-pipe
   - two-pipe

5. Describe the procedures used to design secondary zones.
   - common piping
   - common piping flows and mean water temperatures

6. Describe the procedures used to install radiator valves.

7. Describe thermostatic valves, their parts, operation and applications.

8. Describe electric zone control valves, their parts, function and applications.

9. Explain the following terms:
   - cross connection
   - back flow prevention

10. Describe piping vacuum breakers, their parts, operation and applications.

11. Describe the various types of devices used for protection of cross connection control and their applications.

12. Describe the operation and applications of thermostats.
   - line voltage
   - low voltage
   - automatic set back
   - multiple fuel supply applications

13. Describe the operation and specify the use of limit controls.
   - hot water limits
   - warm air limits

14. Describe the operation and specify the use of primary controls.

15. Describe the operation and specify the use of control systems.
   - warm air
   - hot water

16. Explain the operation of energy modulating controls.

17. Identify drawing symbols for the main components of a single-line drawing of a basic low pressure hot water heating cycle.

18. Describe the operation of pressure reducing valves.

19. Describe the operation and applications of vacuum valves.

20. Describe the operation and applications of flow-control-control valves.

21. Describe the operation and applications of motorized valves.

22. Describe the operation and applications of two types of circulating pumps.

23. Describe the various types of safety controls, their operation and applications.
    - low water cutoff and fusible plugs
    - feeder cutoff combinations
    - high and low water alarms
    - pressure controls
    - water column, gauge glass, and try-cock combinations
    - boiler trim
    - drain and blow-down valves, pigtails and steam gauges

24. Describe the various types of instrument controls and indicating devices, their operation and applications.
    - temperature and level controls
    - orifice flanges
    - transmitters
    - pressure indicating devices
    - aquastats
    - airstats
    - thermostats
    - protector relays
    - control panels
    - photo cells
    - limit switches

25. Describe the procedures used to select, lay out and install piping for hot water heating systems.
    - loop system
    - monoflo system
    - multi-zone system

26. Describe the procedures used to remove air from hydronic systems.

27. Describe methods of heat transfer.
    - radiation
    - conduction
    - convection

28. Describe procedures used to install mono-flow-control and two pipe distribution systems.
    - mono-flow-control tees (copper and black iron)
    - mono-flow-control systems (up-feed and down-feed)
    - trunk system
    - series loop system
    - mono-flow-control and series system
    - two pipe direct return system
    - two pipe reverse return system
    - balancing valves

29. Describe the purpose, parts and operation of heat pumps.

30. Describe the procedures used to install heat pumps.

31. Describe the components and operation of the various types of solar heating systems.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- compile material list for a commercial heating system.
- layout piping for a hot water heating system.
- remove air from a hydronic system.

PIP-1160 Cross Connection Control Devices

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber task 18
- Steamfitting/Pipefitting tasks 13, 14, 15, 23 & 24

Description:

This course is designed to introduce the purpose, location and installation of cross connection control devices encountered in the piping industry. Course material covers:

- cross connection
- backflow prevention devices
- cross connection devices

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140

Course Outcome:

Upon successful completion of this course, the apprentice will be able to:

- identify cross connections and determine how to correct them

Required Knowledge and Skills:

1. Identify and interpret sources of information pertaining to installation.
   - the Canadian Plumbing Code
   - manufacturers' literature

2. Describe the division of responsibilities for cross connection control.
   - installation
   - troubleshooting
   - repair

3. Describe the cross connection control program.
   - administration
   - legal aspects

- health aspects
- minimum standards
- inspection of devices
- licensing of testers
- testing of devices

4. Describe the various methods and devices used for cross connection control, their location and operation in various systems.

5. Describe the procedures used for maintenance and repair of devices.
   - troubleshooting
   - repair procedures

6. Describe the causes of backflow, and their role in cross connection.

7. Describe backflow control.
   - causes
   - classification of hazards
   - assessment of hazards
   - types of devices
   - selection of proper devices
   - methods of backflow control
   - typical occurrences and recommended protection

8. Describe the purpose and operation of:
   - back siphonage devices
   - back pressure devices

9. Describe testing of devices.
   - non-testable devices
   - testable devices
   - methods of testing
   - testing procedures

10. Describe the procedures used to install devices.
    - location of devices
    - Canadian Plumbing Code applications
    - manufacturer's recommendations
    - warranty of devices
    - report of installation

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- classroom exercises as determined by the instructor.

PIP-1165 Introduction to Electricity

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for

- Plumber tasks 23, 30, 31 & 36

Description:

This training course introduces the principles of electricity encountered in the piping trades. Course material covers:

- electrical terminology
- direct and alternating current
- electrical circuits
- electrical motors
- abbreviations and symbols

Prerequisites:

None

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate an understanding of electrical principles.

Required Skills and Knowledge:

1. Explain electron theory, Ohm's Law and associated formulae.

2. Explain electrical terminology.
   - colombe
   - voltage
   - current
   - ampere
   - resistance
   - ohm

3. Describe what is meant by resistance and the factors affecting it.

4. Describe the characteristics of conductors and insulators and their applications.

5. Describe electromagnetism and how it can be used to produce voltage.

6. Describe direct current and how it is created.

7. Describe the trade related applications of direct current.

8. Describe alternating current and how it is created.

9. Explain terms relating to alternating current.
   - cycle
   - Hertz
   - effective value
   - electrical characteristics

10. Describe electrical circuits, their components and operation.

11. Describe the procedure used to construct electric circuits.
   - series
   - parallel
   - series-parallel

12. Describe the causes of excessive current.

13. Describe overload protection circuits.

14. Interpret the abbreviations, formula symbols and circuit symbols found in circuit diagrams.

15. Describe the parts and operating principles of electric motors.

16. Describe the components and operation of a split phase centrifugal switch motor.
   - start switch
   - overload switch
   - internal wiring
   - connections
   - capacitors

17. Describe the procedures used for troubleshooting and repair of electric motors.

18. Define and explain electrolysis.

19. Describe the detrimental effect of electrolysis on piping.
    - dissimilar piping
    - incompatible pipe hanger
    - underground installations of liquid and gas lines

20. Read and interpret electrical schematic.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- classroom exercises as determined by the instructor.

PIP-1170 Introduction to Gas Piping

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 25, 26 & 27
- Steamfitting/Pipefitting task 13

Description:

This course is designed to introduce the principles of installation, testing, operation and repair of gas systems and to provide an appreciation of the special considerations required to safely install gas burning appliances and units under the appropriate codes and standards. Course material covers:

- components
- piping
- safe practices

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- describe how to safely install gas piping for commercial and industrial applications
- describe approved testing methods and procedures, with the public safety in mind

Required Knowledge and Skills:

1. Identify and interpret regulations governing natural gas and propane systems.

2. Identify and interpret regulations governing transportation and storage of gas cylinders.

3. Describe the properties and characteristics of natural gas.
   - odor, color and taste
   - state
   - composition

- toxicity
- specific gravity
- flame type
- excess air
- air composition
- heating value
- flame temperature and speed
- limits of flammability
- ignition temperature
- combustion process

4. Describe the purpose, parts and operation of a gas distribution system from the well head to the service regulator.
   - gas well
   - compressor station
   - city gate station
   - district regulating station
   - regulators. high pressure distribution service
   - high pressure distribution lines
   - line pressures

5. Explain gas piping terminology.
   - gas main
   - gas service
   - shut-off valves
   - service regulator
   - meter
   - branch line
   - riser
   - drop line
   - dirt pocket
   - piping extension
   - concealed piping
   - flexible connector

6. Describe safe gas piping practices and procedures.
   - gas code
   - materials
   - pipe coating
   - reaming
   - threading
   - bushings
   - brazing
   - joint compounds
   - gasket material

- grades
- supports
- protection from freezing
- prohibited practices
- limitations at certain locations
- outlets
- concealed piping
- pipe identification

7. Describe the types of gas pressure regulators, their purpose and operation.
   - low capacity
   - high capacity
   - combination
   - loading element
   - measuring element
   - restricting element

8. Describe the procedures used to test a gas line.
   - before appliance is connected
   - after appliance is connected
   - after gas is turned on in the system
   - purging a gas line

9. Describe and explain the factors that determine the correct pipe sizing for gas installations.
   - length of pipe
   - allowable pressure loss
   - system capacity
   - specific gravity of gas
   - number and type of fittings

10. Describe the procedures used to size a low pressure pipe line to a single appliance system.
    - isometric drawing
    - lengths
    - appliance rating btu's /hr
    - convert to cfh
    - tables

11. Describe the procedures used to size a low pressure pipe line for a multiple appliance system.
    - isometric drawing
    - indicate pipe lengths
    - rate appliances in kW per hour
    - convert kW to m^3/hr

- lmr
- tables
- size back towards meter

12. Describe the procedures used to size a high pressure pipe line for a single appliance.
    - high pressure systems allow a 50% pressure loss
    - LMR
    - friction loss
    - equivalent length for fittings
    - LER for pipe and fittings
    - tables

13. Explain the purpose and operation of gas venting.
    - gravity or natural venting
    - spillage
    - combustion process
    - carbon monoxide

14. Explain the operation of the venting action for an atmospheric burner.
    - neutral over fire draft
    - draft control
    - flue gas temperatures

15. Describe the procedures used to size combustion and ventilation air.
    - combustion
    - dilution
    - ventilation
    - unconfined space
    - confined space

16. Describe the purpose, types and applications of appliance draft controls.
    - vertical
    - horizontal
    - horizontal to vertical
    - vertical to horizontal
    - installation requirements
    - barometric control
    - size

17. Describe the purpose and types of vents used for venting a gas appliance.
    - type
    - factory built
    - masonry or concrete
    - metal

18. Describe the purpose and applications of vents.
    - type bh
    - type bw - oval double wall
    - type l
    - type c - single wall

19. Describe the parts, applications and limitations of a b-vent.
    - clean-out
    - base tee and starter assemblies
    - fire stop
    - roof flashing
    - storm collar and vent cap

20. Describe good venting practices.
    - turns
    - grade and installation of vent connector
    - dampers in flue
    - distances
    - horizontal length
    - connecting vents

21. Describe the procedure used to size a vent for a single appliance.
    - total height
    - input in btu or kilowatts
    - lateral length
    - appliance tables

22. Describe the procedure used to size a vent for multiple appliances on the same level.
    - connector size
    - vent size

23. Describe the procedures used to layout and install a gas piping system.

24. Describe the procedures used to test and purge the system.

25. Describe the procedures used to install gas meters.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- classroom exercises as determined by the instructor.

PIP-1175 Specialty Piping Systems

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis
- Plumber task 28
- Steamfitting/Pipefitting task 13

Description:

This training course introduces the principles and applications of specialty systems encountered in the piping trades. Course material covers:
- type of system
- associated piping
- code requirements
- installation procedures

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- identity specialty piping applications
- describe procedures for the installation of Fire Protection systems
- describe procedures for the installation of Residential Sprinkler Systems
- describe procedures for the installation of Food Processing systems
- describe procedures for the installation of Medical Gas systems
- describe procedures for the installation of Compressed Air and Vacuum systems
- describe procedures for the installation of Chilled Water systems
- describe procedures for the installation of Solar Heating systems
- describe procedures for the installation of Pneumatic Transfer systems

Required Knowledge and Skills:

FIRE PROTECTION SYSTEMS

1. Describe types of fire line systems, their component parts and operation.
   - standpipe
   - (wet and dry)
   - automatic sprinkler

2. Describe the various methods of supplying water to system
   - siamese connection
   - tanks
   - pumps

3. Identify and interpret sources of information pertaining to installation.
   - drawings
   - specifications
   - manufacturer's literature

4. Describe the procedures used to make piping connections to main water supply.

5. Identify and interpret the National Building Code, the Canadian Plumbing Code and all other codes that may apply to the fabrication, application and testing of fire protection systems.

6. Describe the procedures used to install and test fire protection systems.
   - location
   - pressure
   - regulations (refer to codes)
   - cross connection prevention
   - safety

RESIDENTIAL SPRINKLER SYSTEMS

7. Describe the purpose, components and operation of residential sprinkler systems.

8. Describe the materials and layout procedures required to install residential sprinkler systems.

9. Describe the procedures used to install residential sprinkler systems.

10 Identify and describe sources of information pertaining to residential sprinkler system installation, maintenance and testing**.**
   - drawings
   - specifications

- manufacturers’ literature
- codes and regulations

FOOD PROCESSING SYSTEMS

11. Identify and interpret sources of information pertaining to installation.
    - drawings
    - specifications
    - manufacturers' literature
    - regulations and codes

12. Describe the various types of food processing systems, their purpose, components and operation.

13. Describe indirect waste connections, their purpose and installation.

14. Describe venting requirements and arrangements for food processing systems.

15. Describe traps and trap primers, their purpose, operation and location.

16. Describe cleanouts, their purpose and location.

17. Describe procedures used to install food processing systems.

18. Describe various types of food processing equipment and accessories, their purpose, operation and installation.
    - ice makers
    - potato peelers
    - drink dispensers
    - food coolers
    - food processing tables
    - steam table

19. Describe procedures used to install food processing equipment.

MEDICAL GAS SYSTEMS

20. Identify and interpret sources of information pertaining to installation.
    - drawings
    - specifications
    - manufacturers literature

21. Describe medical gas systems, their components, materials and operation.

22. Describe materials and procedures used to join piping for medical gas systems.
    - silver solder
    - silver braze

23. Describe oxygen supply systems, their components and installation.
    - piping and fittings
    - jointing methods
    - wall outlets
    - valves
    - testing

24. Describe vacuum systems, their components and installation.
    - vacuum pumps and receivers
    - piping and fittings
    - wall outlets
    - valves
    - testing

25. Describe anesthetic gas systems, their components and installation.
    - piping and fittings
    - wall outlets
    - valves
    - testing

26. Describe nitrogen gas systems, their components and installation.
    - piping and fittings
    - wall outlets
    - valves
    - safety devices
    - testing

27. Describe vacuum tube and compressed air systems.
    - compressors
    - piping and fittings
    - reducing stations
    - valves and strainers
    - pressure gauges and controls
    - safety devices
    - testing

28. Describe the color coding of medical gas systems.

29. Identify and interpret the sections of the Canadian Plumbing Code and all other codes that may apply to the installation of medical gas systems.

30. Describe the procedure used to purge medical gas systems.

COMPRESSED AIR AND VACUUM SYSTEMS

31. Explain air theory.
    - effects of water within a system
    - humidity
    - air treatment and storage
    - safety

32. Identify component parts of a vacuum system and describe their purpose.

33. Identify and interpret sources of information pertaining to installation.
    - drawings
    - specifications
    - manufacturers' literature

34. Describe the types of compressors, their operation and applications.
    - rotary liquid-type air
    - piston-type air

35. Describe the procedures used to install compressors.
    - cold climate
    - damp climate or high humidity
    - bases and foundations

36. Describe the procedures used to install compressor piping.
    - inlet piping
    - discharge piping
    - safety valves
    - shut-off valves
    - controls
    - condensate drain valve/trap

37. Describe the procedures used to install distribution piping to draw-off point.
    - systems–laboratories, instrumentation, workshops
    - supports
    - materials
    - branch connections off main
    - drop lines
    - drains
    - shut-off valves
    - equipment quick-connects

38. Describe the procedures used to install vacuum-cleaning system (commercial).
    - design and installation factors
    - types of piping and installation
    - inlet locations and detail
    - number of inlets
    - location of power unit (vacuum producer) and detail
    - venting power unit

39. Describe the procedures used to install commercial vacuum-cleaning systems.
    - design and installation factors
    - types of piping and installation
    - types of inlets
    - power units
    - location and installation of power unit

CHILLED WATER SYSTEMS

40. Describe the purpose, component parts and operation of a chilled water system.

41. Identify and interpret sources of information pertaining to installation.
    - drawings
    - specifications
    - manufacturers' literature

42. Describe the procedures used to install a chilled water system.

SOLAR HEATING SYSTEMS

43. Describe the types of solar heating systems, their operating principles and applications.
    - passive
    - forced
    - direct
    - indirect

44. Describe the component parts of the various types of solar heating systems, their purpose and operation.
    - piping
    - solar panels
    - insulation
    - controls and sensors
    - storage
    - pumps

45. Identify and interpret sources of information pertaining to installation.
    - drawings
    - specifications
    - manufacturers' literature

46. Describe the procedures used to install a solar heating system.
    - piping
    - solar panels
    - insulation
    - controls and sensors
    - storage
    - pumps
    - electrolysis
    - purging

PNEUMATIC TRANSFER SYSTEMS

47. Describe the purpose, applications and operation of pneumatic transfer systems.

48. Describe the parts of a pneumatic transfer system and their operation.

49. Describe the procedures used to install a pneumatic transfer system.

50. - Identify and interpret sources of information pertaining to installation.
    - drawings
    - specifications
    - manufacturers' literature

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- classroom exercises as determined by the instructor.

PLG-1150 Rural Water Supply

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis

- Plumber tasks 15, 16, 18, 30, 31 & 36
- Steamfitting/Pipefitting task 14

Description:

This course is designed to give apprentices the knowledge and skills necessary for the installation, operation, testing and maintenance of rural water supply systems. Course material covers:

- types of wells
- types and operation of pumps
- pressure tanks

Prerequisites:

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate understanding of the operation of rural water supply systems
- demonstrate understanding of the operation, installation and repair of water pumps

Required Knowledge and Skills

INTRODUCTION TO RURAL WATER SUPPLY

1. Describe the surface sources of water supply.
   - rivers
   - lakes
   - ponds
   - streams
   - cisterns

2. List and describe the most common contamination sources of water supply.
   - rural sewage disposal and farm run off
   - chemical lawn spraying
   - fertilizers

3. Describe and explain the types of wells, their characteristics, advantages and disadvantages.
   - shallow
   - deep
   - dug
   - bored
   - driven
   - drilled

4. Describe and explain well terminology.
   - static water level
   - draw on
   - recovery rate
   - well casing
   - submergence
   - well cap
   - pumping water level
   - water seams
   - well capacity

5. Describe the various purposes of and information contained in a well driller's report.
   - well owner
   - well contractor
   - well log
   - well information
   - method of drilling
   - water usage
   - pumping rate

6. Describe the purpose and use of the Well Drilling Regulations in respect to:
   - definitions
   - location of well
   - protection of aquifers
   - pump installation
   - well construction records
   - well drilling advisory board duties
   - licensing - general provisions
   - well drilling licence
   - constructing wells by drilling, standards for equipment
   - application for well digging licence

POSITIVE DISPLACEMENT PUMPS & ACCESSORIES

7. List and describe the components of a hydro-pneumatic system
   - foot valve
   - piping
   - clamps
   - pumps
   - pressure tanks
   - controls
   - shut-off valves
   - drainage

8. Describe types of positive displacement pumps and their operating principles.
   - gear
   - helical rotary
   - pressures
   - relief valve
   - lift
   - types of liquids

9. Describe the parts and operation of a shallow well reciprocating pump.
   - single acting
   - double acting
   - dual double acting
   - lift
   - gpm
   - relief valve
   - priming
   - pump chart
   - pressure switch

10. Describe the installation procedure for a shallow well double acting piston pump.
   - location
   - pump tapping size
   - suction line
   - grade
   - depth
   - foot or check valve
   - noise control

JET PUMPS

11. Describe the types of shallow well jet pump, their parts and operation.
   - lift
   - single stage

- multi-stage
- impeller
- diffuser
- ejector
- pressure switch
- motor size

12. Describe the parts and operation of a deep well jet pump.
    - single stage
    - multi-stage
    - lift
    - suction line
    - drive line
    - deep well ejector
    - tail pipe
    - pitless adapter
    - air vent
    - control valve
    - pressure switch
    - foot valve

13. Describe the installation and start up procedures for shallow and deep well jet pumps.
    - depth
    - frost protection
    - priming
    - control valve

14. Describe how to read a shallow and deep well jet pump chart.
    - types of ejectors
    - motor HP
    - jet settings
    - pipe size
    - l/s
    - gpm
    - flow rate

15. Describe a packer deep well jet package and its operation.
    - pump type
    - size of well
    - ejector
    - packers
    - casing, well casing adapter

SUBMERSIBLE PUMPS

16. Describe the parts and operation of a submersible pump.
    - pump size
    - check valve
    - discharge head
    - impellers
    - diffusers
    - suction screen
    - cable lead - splicing
    - motor size
    - voltage
    - torque arrestor
    - wire guard

17. Describe the procedure used to wire a two or three wire submersible pump.
    - wire size
    - distance
    - voltage phase
    - control box
    - start capacitor
    - relay
    - pressure switch

18. Describe the installation procedure for a submersible pump.
    - inspect pump
    - electrical preparation
    - torque arrester
    - taping wires
    - aligning pump
    - checking flow

19. Describe how to read a submersible pump chart.
    - pumping depth
    - pressure
    - l/s
    - g.p.m.
    - head loss

PRESSURE TANKS AND CONTROLS

20. List and explain the reasons for a pressure tank in a pump system.
    - prevent rapid cycling
    - allows pump a shut down period
    - storage

- water compatibility - galvanized
- glass lined
- fiberglass

21. Explain pressure tank terminology.
    - capacity
    - cycle rate
    - demand
    - draw-down
    - usable water
    - minimum operating pressure
    - peak demand period
    - supercharge
    - recharge
    - water logging
    - pressure
    - pump start pressure
    - supplemental supply

22. Describe and explain the operating principles of pressure tanks.
    - standard galvanized tank with an air volume control
    - standard galvanized tank with a floating diaphragm
    - diaphragm tank
    - bladder tank
    - floated tank
    - in-line tank
    - vertical and horizontal tanks

23. Describe the procedures used to size a pressure tank.
    - tank dimensions
    - 7 minute peak demand
    - tank selection tables
    - manufacturers' rules
    - pump run time

24. Describe the operation of an add air type and a air release type air volume control.
    - snifter valve
    - diaphragm type
    - float operated type
    - vacuum booster

25. Describe the operation of a pressure switch, float switch and liquid level controllers.
    - switch settings
    - differential nut
    - range nut

- low water cut off switch
- depth of floats
- electrical hook up

26. Describe the procedures used to measure flow from a pump.

PUMP SERVICE AND MAINTENANCE

27. Describe the use of gauges to diagnose pump problems.
    - pressure gauge
    - compound gauge
    - vacuum gauge - in feet
    - in inches

28. Describe the use of pump charts to diagnose causes and correct problems in a jet pump.
    - failure to start or run
    - overheating or tripping out
    - frequent starting or stopping
    - failure to shut off
    - little or no water delivery

29. Describe the use of pump charts to diagnose causes and correct problems in a submersible pump.
    - failure to start or run
    - overheating or tripping out
    - frequent starting or stopping
    - failure to shut off
    - little or no water delivery

30. Describe the use of pump charts to diagnose and correct problems in a reciprocating pump.
    - failure to start or run
    - little or no water delivery
    - low capacity
    - pump loses its prime
    - frequent starting or stopping
    - failure to shut off
    - excessive operating noise

31. Describe the procedure for taking an ammeter test reading for a pump motor.
    - pull wires away
    - set meter
    - put on meter tongs
    - select scale

- check manufacturers' specs

32. Describe the basic steps for using an ohmmeter to determine pump motor winding continuity.
    - turn off power
    - set up meter
    - set scale

33. Describe the basic steps for using an ohmmeter to determine if the insulation of the pump motor or cable has been damaged.
    - turn off power
    - select settings
    - attach leads
    - take reading

34. Describe the basic steps for using an ohmmeter to determine ground leakage in the motor and cable.
    - turn off power
    - set scale
    - immerse cable
    - check readings

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- install a water displacement piston pump and accessories.
- install a centrifugal jet pump (shallow well).
- install a submersible pump and accessories.

PLG-1100 Water Supply 1 (Water Service)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber tasks 16, 17 & 18.

Description:

This training course introduces the principles of water supply to residential, commercial and industrial applications through municipal water supplies. Course material covers:

- water mains
- cold water supply equipment
- piping for potable water supply services
- water meters
- municipal distribution systems

Prerequisites:

PIP-0100

Course Outcomes:

Upon completion of this course, the participant will be able to:

- demonstrate understanding of how water supply equipment functions
- install piping systems for potable and non-potable water supplies

Required Knowledge and Skills:

1. Describe the procedures used to determine elevations and grades for water supply piping.

2. Describe the procedures used to lay out and shore trenches.

3. Describe the procedures used to make connections to curb stops.
   - service pipe
   - main valves and water meters

4. Identify and interpret the Canadian Plumbing Code sections as they apply to the fabrication, application and testing of water service pipe.

5. Describe the procedures used to install water services to buildings.
   - purpose of water services
   - equipment and materials
   - installation practices
   - safety considerations
   - installation considerations and methods
   - plumbing requirements

6. Describe water service component parts and their functions.
   - water main
   - corporation stop or cock
   - curb stop
   - meters
   - meter yoke
   - by-pass
   - strainers
   - flow meters
   - check valves
   - back flow preventers

7. Describe the various types of water meters, their purpose and operation.
   - types
   - positive displacement
   - turbine
   - location

8. Identify and interpret code regulations pertaining to the installation of water meters.

9. Describe the procedures used to install water supply for outbuildings.
   - components of the pumping system
   - tasks and sequence
   - piping practices

10. Describe gravity water supply systems.
   - classes
   - with or without pump
   - installation methods and considerations

11. Identify and interpret code regulations pertaining to the selection and installation of water pipes.

12. Describe the procedures used to determine requirements and procedures.
   - drawing
   - specifications and manufacturer's literature

13. Describe the procedures used to install supports:
    - determine elevations and grades
    - lay out and shore trenches
    - install anchors, tie rods and thrust blocks
    - Canadian Plumbing Code

14. Describe the procedures used for supporting, anchoring, and rodding cold water pipe.
    - protecting pipe from freezing, settling and blowouts
    - blocking and rodding pipe
    - changes of direction
    - backfilling

15. Describe the procedures used to install anchors, tie rods, thrust blocks and supports for water service.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the participant's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- install water meters.

PLG-1105 Water Supply 2 (Hot & Cold Water Supply Rough-In)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber tasks 17, 18, 35 & 36.

Description:

This training course introduces the installation of water supply piping systems. Course material covers

- hot and cold water supply equipment
- piping for potable water supply services

Prerequisites.

PIP-0100, 1120, 1125, 1130, 1135, 1140, PLG-1100

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate understanding of procedures used to rough-in and install hot and cold water systems
- install piping systems for potable and non-potable water supplies

Required Knowledge and Skills:

1. Describe the term “roughing-in”.
   - considerations when roughing-in
   - importance of adhering to code

2. Describe procedures used to lay out the locations of fixtures and piping.

3. Describe procedures used to rough-in and install.
   - hot and cold water piping
   - valves
   - shock absorbers
   - air chambers
   - recirculating lines and pumps

- connections to hot water storage tanks
- Canadian Plumbing Code sections which apply to the fabrication, application and testing of potable hot and cold water supply piping.

4. Describe the procedures used to layout and install water supply lines.
   - water distribution system
   - typical installation
   - definitions
   - expansion of hot water lines
   - installation methods and procedures
   - considerations
   - types of pipes and fittings
   - types of solder
   - location and types of valves (access panels)
   - purpose and types of insulation
   - location and size of sleeving
   - pressure reducing valves
   - booster pumps
   - trap primers (cross connections)
   - hangers
   - frost protection

5. Describe the purpose and installation of recirculating lines.
   - gravity circulation
   - forced circulation
   - piping arrangements
   - circulating pumps

6. Describe the procedures used to install support.
   - considerations
   - materials
   - code information
   - types of hangers and supports

7. Describe the procedures used to install hose bibs and non-freeze hydrants.

8. Define the term hammer, its causes, problems and methods of controlling in a residential application.
   - air chambers
   - water hammer arrestors

9. Describe procedures used for testing installations.

10. Describe the procedures used to size water supply systems.

Suggested Learning Activities.

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- prepare material take-offs from plans.
- layout and install hot and cold water rough-in to a single family dwelling as per specifications and regulations.

PLG-1110 Water Supply 3 (Hot Water Storage Tanks & Heaters)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber tasks 18, 35 & 36.

Description:

This training course introduces the principles of water supply to residential, commercial and industrial applications through municipal water supplies. Course material covers:

- hot water tanks
- water storage tanks

Prerequisites.

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140, PLG-1100, 1105, 1110, 1125

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- demonstrate understanding of how hot water heaters function
- install domestic hot water heaters and storage tanks

Required Knowledge and Skills:

1. Identify and interpret drawings, specifications and manufacturer's literature.

2. Describe the procedures used to install storage tanks and heaters.
   - related piping
   - safety valves and controls
   - dip tubes in hot water storage tanks

3. Describe the procedures used to connect coils to storage tanks.

4. Describe safety regulations and precautions for the installation of storage tanks and heaters.

5. Identify and interpret Canadian Plumbing Code sections which apply to the application, installation and testing of hot water storage tanks and heaters.

6. Describe sources of heat for tanks.
   - oil
   - gas
   - electric

7. Describe domestic hot water heating equipment, their components and operation.
   - electrolysis
   - dip tube
   - magnesium rod
   - insulation
   - sizing
   - piping
   - source of heat
   - direct heat
   - indirect heat
   - controls and safety devices
   - pressure relief valves
   - temperature relief valves
   - combined pressure/temperature relief valve
   - aquastats and thermostats

8. Describe the procedures used to perform various hot water tank installations.
   - direct heating
   - indirect heating
   - water volume expansion
   - considerations

9. Describe the procedures used to plan and carry out installation of water heaters.
   - selecting location
   - installing water pipes and shut off valve
   - installing relief valves
   - filling
   - wiring (electrician)
   - vacuum relief

10. Describe the procedures used to test hot water heaters.

11. Describe the procedures used to estimate materials.

Suggested Learning Activities.

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- layout and install a water heater and/or a water storage and accessories as per specifications and regulations.

PLG-1115 Water Supply 4 (Water Softeners & Conditioners)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber task 18.

Description:

This course introduces the principles of water supply to residential, commercial and industrial applications through municipal water supplies. Course material covers:
- water problems
- residential water softening and treatment

Prerequisites:

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140, PLG-1100, 1105, 1110, 1115, 1125

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- demonstrate understanding of how water treatment appliances function
- install domestic water filters and softeners

Required Knowledge and Skills:

1. Identify and interpret drawings, specifications and manufacturer's literature.

2. Describe testing procedures used to determine treatment required.

3. Describe the procedures used to size water softeners.

4. Describe the procedures used to install water softeners and component parts.

5. Describe potential dangers of and methods of preventing cross connection.

6. Describe water problems, their causes and effects.
   - hardness
   - minerals

- contamination
- acid
- taste and odor

7. Describe the devices used to correct water problems, their types and characteristics.
   - filters
   - softeners
   - conditioners

8. Describe the procedures used for installation of water softeners and filters.
   - protection from cross connections

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- select and install the appropriate water softening appliance.
- perform a water analysis test.
- size a water softener.

PLG-1120 Drainage & Venting Systems 1 (Residential)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber tasks 8, 9, 12, 13, 14, 35 & 36.

Description:

This training course introduces the principles of drainage and waste systems and the installation of drainage, waste and venting system for basic residential applications. Course material covers:

- building sewers
- sanitary drainage systems

Prerequisites:

PIP-0100, 0105, 1135

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- size building sewers and sanitary drainage systems
- install basic domestic drainage and venting systems

Required Knowledge and Skills:

SANITARY DRAINAGE SYSTEMS

1. State the purpose and theory of drainage and venting systems.
   - protect health and sanitation
   - remove liquids and water-borne waste
   - provide circulation of air within plumbing system
   - prevent siphoning and back pressure

2. Identify and describe the types of building sewers and the methods of connecting to and piping used.
   - sanitary
   - storm

- combined

3. Explain the methods of sizing the building sewer.
   - interpret code requirements
   - determine hydraulic load (fixture units)
   - determine grade

4. Describe the process and procedures for installing piping and services in trenches.
   - safety factors
   - tools/equipment
   - support
   - protection

5. Describe the purpose of grading pipes.
   - waste
   - vent
   - heating

6. Describe the methods of calculating grade and percent of grade.
   - fall
   - grade/percent of grade
   - run

7. Describe the tools used for grading pipes.
   - level
   - builders level/transit
   - laser
   - tape measure

8. Describe the procedures used to perform measurements and determine elevations on vertical pipe.

9. Define common terminology associated with residential drainage and waste systems.

10. Describe the components of a residential plumbing drainage system.
    - building drain
    - branch
    - stack
    - fixture
    - fixture drain
    - trap arm
    - fixture outlet pipe
    - clean-out
    - floor drain

11. Describe the sequencing of procedures used to rough-in a complete residential plumbing drainage system.
    - review drawings and specifications
    - sizing, material list take off
    - scheduling and planning
    - excavation, cutting holes, installation, testing, inspection

12. Define the terms fixture unit and hydraulic load. List the types of common residential plumbing fixtures.

13. Describe the significance of plumbing fixtures to the sizing of drainage and vent systems.
    - outlet size
    - volume/capacity
    - waste and water connections

14. Describe the angles of branches and bends in a drainage or venting system.
    - wye
    - sanitary tee
    - elbow/bend

15. Explain the methods of sizing the building drain.
    - interpret plumbing code requirements
    - determine hydraulic load (fixture units)
    - determine grade

16. Describe the procedures for installing the building drain.
    - location of fixtures/services
    - material lists
    - excavation
    - installation/support
    - protection/ identification
    - testing and inspection

17. Explain the methods of sizing the soil or waste stack.
    - interpret plumbing code requirements
    - determine hydraulic load (fixture units)

18. Describe the procedures for installing the soil or waste stack.
    - location of fixtures/services
    - material lists
    - interference
    - locate and cut openings
    - installation/support
    - testing and inspection

19. Describe the methods of sizing fixture drains and branches.
    - interpret plumbing code requirements
    - determine hydraulic load (fixture units)

20. Describe the methods of locating services and cutting/modifying structural members to rough-in plumbing systems.
    - wood framing

21. Describe the purpose of cleanouts.
    - type
    - size
    - location/accessibility
    - interpret plumbing code requirements

22. Describe traps, trap seals, floor drains and their function.
    - size
    - type
    - trap primers
    - interpret plumbing code requirements

23. Describe the methods used in locating floor drains and cleanouts in slabs to achieve finished elevations.

24. Describe trap seal loss and how to prevent it.
    - siphonage
    - back pressure
    - capillary attraction
    - interpret plumbing code requirements

25. Explain the acceptable methods of testing.
    - underground drainage systems
    - above ground drainage, waste and vent systems
    - fixtures
    - interpret plumbing code requirements

26. Describe the methods of providing back flow protection for drainage systems.
    - back water valve
    - plug
    - gate valve

27. Describe the procedure used to perform material list take off from plans.

VENTING RESIDENTIAL PLUMBING SYSTEMS

28. Define common terminology associated with residential venting systems.

29. Describe the possible elements of a residential plumbing venting system.
    - stack vent
    - individual vent
    - dual vent
    - branch vent
    - header
    - continuous vent
    - wet vent (four fixtures or less)

30. Describe the procedures for installing the various residential vent systems.
    - material lists
    - interference
    - locate and cut openings
    - installation/support
    - protection
    - testing and inspection

31. Explain the methods of sizing a stack vent.
    - interpret plumbing code requirements
    - determine hydraulic load (fixture units)
    - determine developed length

32. Describe various types of individual vents, their characteristics and applications.

33. Explain the methods of sizing an individual vent.
    - interpret plumbing code requirements
    - determine largest trap served

34. Explain the methods of sizing a dual vent.
    - interpret plumbing code requirements
    - determine largest trap served

35. Explain the methods of sizing a branch vent.
    - interpret plumbing code requirements
    - determine hydraulic load (fixture units)
    - determine developed length

36. Explain the methods of sizing a header.
    - interpret plumbing code requirements
    - determine hydraulic load (fixture units)
    - determine developed length

37. Explain the methods of sizing a continuous vent.
    - interpret plumbing code requirements
    - determine size of trap

- determine hydraulic load (fixture units)
- determine developed length

38. Explain the methods of sizing wet vents (four fixtures or less).
    - interpret plumbing code requirements
    - determine fixture type/trap sizes
    - determine hydraulic load (fixture units)
    - number of storeys
    - offset length

39. Describe vent terminals and their function.
    - interpret plumbing code requirements
    - frost protection
    - flashing
    - installation methods

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- perform material list take off from plans.
- sketch residential drainage systems.
- size, install and test drainage systems and venting systems
- calculate grade and elevations.
- size, install and test venting systems.
- calculate vent height connections according to Canadian Plumbing Code.

PLG-1125 Drainage & Venting Systems 2 (Commercial)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber 7, 8, 9, 12 & 14.

Description:

This training course introduces the principles of drainage and waste systems and the installation of drainage, waste and venting system for commercial applications. Course material covers:

- building sewers
- sanitary drainage systems
- storm drainage
- commercial venting systems
- barrier free requirements

Prerequisites:

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140, PLG-1100, 1120

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- size building sewers and sanitary drainage systems for commercial applications
- install venting systems for commercial applications
- size building storm drains and storm drainage systems
- install commercial plumbing systems for barrier free requirements

Required Knowledge and Skills:

COMMERCIAL DRAINAGE SYSTEMS

1. Describe the tools, methods and procedures used to size and install a building sewer for a commercial complex.
    - tools used for grading pipes
    - plumbing code requirements
    - installing piping and services in trenches

2. Describe the procedures used to determine elevations and grades.

3. Describe the procedures used to size interceptors.

4. Describe the procedures used to lay out and install interceptors.

5. Identify and interpret the Canadian Plumbing Code sections which apply to the fabrication, application and testing of interceptors.

6. Describe the maintenance and cleaning of interceptors.

7. Describe the purpose, planning and installation of cleanouts and manholes in a commercial comples:
   - types, identification
   - locations/spacing
   - access and accessibility
   - plumbing code requirements

8. Describe the types of traps used in plumbing systems, their purpose, components and applications.

9. Describe the various methods and systems of maintaining trap seals.
   - trap seal primers
   - indirectly connected fixtures
   - manual replenishment

10. Describe the various types of trap seal primers.
    - single and multiple distribution units
    - electronic systems
    - flush tanks
    - individual fixtures

11. Explain floor drain terminology.
    - drain body
    - receiver
    - grate/strainer
    - flashing collar/gasket
    - leveling screws
    - primer connection
    - floor sink
    - flushing drain

12. Describe the procedures used to locate and install floor drains.
    - determine low point
    - layout

- cut/sleeve openings
- installation/secure/protection
- connection to piping

13. Explain the procedures for installing drains and vents for dishwashers and garbage grinders.

14. Describe the sequencing and procedures used to rough-in a complete commercial plumbing drainage system.
    - review drawings and specifications
    - sizing
    - material list take off
    - scheduling and planning
    - excavation, coring/sleeving
    - installation, testing, inspection

STORM DRAINAGE SYSTEMS

15. Describe the purpose, properties and theories of storm drain systems and combined systems.

16. Explain common terminology associated with storm drainage systems.

17. Describe the components of a commercial storm drainage system:
    - storm building sewer and storm building drain
    - combined building sewer and storm building drain
    - combined sewer
    - sub-soil drains
    - roof drains

18. Describe the procedures used to determine the hydraulic load from roofs or paved surfaces and explain rainfall intensities.

19. Identify and interpret plumbing code requirements for storm drain systems.

20. Explain the procedures of sizing the storm building drain or sewer or combined building sewer.
    - interpret plumbing code requirements
    - determine hydraulic load
    - determine grade

21. Explain the procedures of sizing rain water leaders.
    - interpret plumbing code requirements
    - circular/non-circular
    - determine hydraulic load

22. Describe the procedures for installing rain water leaders.
    - piping materials
    - interference
    - hangers and support
    - protection and identification
    - testing and inspection

23. Explain the methods of sizing roof gutters.
    - interpret plumbing code requirements
    - determine hydraulic load
    - determine grade
    - determine area of gutter

24. Describe the following roof drain terminology:
    - drain body
    - receiver
    - dome
    - extension
    - clamping ring
    - gasket
    - deck clamp

25. Describe the procedures used to locate and install roof and area drains.
    - determine low point
    - layout
    - cut and sleeve openings
    - installation
    - secure/protection
    - connection to piping

26. Describe the methods of protecting rain water leaders from the following:
    - sweating
    - frost/freezing
    - expansion
    - thrust

COMMERCIAL VENTING SYSTEMS

27. Describe the components and function of the following venting systems:
    - stack
    - individual
    - dual
    - branch
    - header
    - continuous

- vent stack
- relief vent
- combined relief vents
- single story wet venting (over four fixtures)
- multi-story wet vent

28. Identify and interpret plumbing codes for commercial venting systems.

29. Describe the procedures for sizing the following venting systems:
    - interpret plumbing code requirements
    - stack
    - individual
    - dual
    - branch
    - header
    - continuous
    - vent stack
    - relief vent and combined relief vents
    - single storey wet venting (over four fixtures)

30. Describe the criteria, code requirements and procedures for installation of:
    - vent pipes for traps
    - miscellaneous vent pipes
    - arrangement of vent pipes
    - minimum size of vent pipes

31. Explain the procedures and rules for connecting fixtures, offsets and vents to venting systems.

32. Describe the procedures used to install the various commercial vent systems.
    - material lists
    - interference
    - location and cutting of openings
    - installation and support
    - protection
    - testing and inspection

33. Describe the location and sizing of vent pipe terminals.

34. Describe the purpose and installation of fresh air inlets.

Suggested Learning Activities:

- perform material list take off from plans.
- sketch commercial storm drainage system.
- size, install and test storm drainage systems according to code.
- size commercial venting systems.
- install and test commercial venting systems according to code.
- calculate vent height connections.

PLG-1130 DRAINAGE & VENTING SYSTEMS 3 (COMMERCIAL/INDUSTRIAL)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for Plumber tasks 12, 13 & 14.

Description:

This course introduces the principles of drainage and waste systems and the installation of drainage, waste and venting systems for large commercial/industrial applications. Course material covers:

- building sewers
- sanitary drainage systems
- storm drainage
- commercial venting systems
- barrier-free requirements

Prerequisites:

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140, 1150, PLG-1100, 1105, 1120, 1125

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- size building sewers and sanitary drainage systems for commercial/industrial applications according to code
- install venting systems for commercial/industrial applications according to code
- size building storm drains and storm drainage systems
- install commercial plumbing systems for barrier-free requirements
- describe applications and installation for so-vent systems

Required Knowledge and Skills:

COMMERCIAL/INDUSTRIAL DRAINAGE COMPONENTS

1. Describe the purpose and components of a municipal sewage system.
   - types of sewer
   - construction and design

- grades and elevation
- methods of connection

2. Describe the function and design of waste water treatment plants.
   - methods of disposal
   - methods of treatment
   - lift stations
   - piping materials and components

3. Describe the terminology and methods of sizing sewage pumps or receiving tanks.
   - capacity
   - function
   - application
   - interpret plumbing code requirements

4. Describe the components and operation of sewage pumps or receiving tanks.
   - materials/covers
   - types of pumps and components
   - control/alarm

5. Describe the methods of installing and servicing sewage pumps and their components.
   - excavation/bedding/backfill
   - pumps and their controllers
   - floats and alarm
   - troubleshooting
   - interpret codes and manufacturers' literature

6. Describe the procedures for connecting sewage sump drains.
   - to building drains
   - arrangement of fittings
   - sizing
   - termination

7. Describe the terminology, purpose and applications associated with indirect wastes.

8. Describe the criteria used to size and install indirect piping connections and air gaps.
   - types of fixtures/equipment
   - fixture outlet sizes
   - material
   - methods of support
   - venting of traps
   - interpret plumbing code requirements

9. Describe the terminology, purpose and common types of interceptors.
   - grease
   - oil/gas
   - sediment/sand

10. Describe the methods of sizing, installing and servicing interceptors.
   - capacity
   - function
   - application
   - plumbing code requirements

11. Describe the procedures used to connect drains and vents of interceptors.
   - to build drains, stacks, branches
   - arrangement of fittings
   - sizing
   - termination

12. Describe the methods of protecting plumbing systems from extreme conditions.
   - high temperature
   - corrosive waste

13. Describe the various types of acid resistant piping systems and explain the safety precautions and installation procedures associated with each.
   - acid resistant plastics
   - glass
   - durilon and teflon
   - stainless steel

14. Describe the methods of treating corrosive waste before entering the plumbing system. Explain the requirements for installation, sizing and venting.
   - acid-dilution tanks
   - neutralizing tanks

15. Describe the theory, function and installation procedures for solvent drainage systems.

16. Identify components of so-vent systems
   - aerator
   - de-aerator
   - stack
   - support
   - anchors

17. Describe the procedures required to install so-vent systems.
   - drawings, specifications and manufacturers literature
   - double in-line offsets
   - offsets in so-vent stacks

- offset at base of so-vent stacks
- soil and waste branches
- sizing of vertical drops
- floor drains
- pressure equalizing and pressure relief lines
- sudsing
- downstream of the pressure relief lines
- fixtures
- types of back-to-back and side-by-side connections for fixtures

CANADIAN PLUMBING CODE–GENERAL

18. Interpret plumbing code requirements and describe general requirements regarding the following:
    - defects
    - exposure
    - re-use
    - identification
    - pipe or piping
    - withstanding pressure

19. Interpret plumbing code requirements and define the requirements for fixtures.
    - surface
    - conformance
    - showers, water closet
    - concealed overflows

20. Interpret plumbing code requirements and define the requirements for traps and interceptors.
    - traps
    - interceptors
    - tubular traps

21. Interpret plumbing code requirements and define the requirements for pipe fittings.
    - T and cross
    - sanitary tee
    - one-quarter bends
    - cession fittings

22. Interpret plumbing code requirements and define the requirements for non-metallic pipe fittings.
    - asbestos cement drainage pipe and fittings
    - asbestos cement water pipe and fittings
    - concrete
    - vitrified clay
    - polyethylene

- cross linked polyethylene
- PVC
- CPVC
- Poly Butylene
- plastic pipe and cement (below ground)
- transition cement
- plastic pipe and cement (above ground)
- composites
- polypropylene

23. Interpret plumbing code requirements and define the requirements for ferrous pipe and fittings.
    - cast iron drainage and vent
    - cast iron fittings for asbestos cement
    - threaded cast iron drainage fittings
    - cast iron water pipes
    - screwed cast iron water fittings
    - screwed malleable iron water fittings
    - steel pipe
    - corrugated steel pipe
    - sheet metal leaders

24. Interpret plumbing code requirements and define the requirements for non-ferrous pipe and fittings.
    - copper and brass
    - brass or bronze fittings
    - copper tube
    - solder joint fittings
    - flared joint fittings
    - lead
    - aluminum

25. Interpret plumbing code requirements and define the requirements for corrosion resistant materials.

26. Interpret plumbing code requirements and define the requirements for jointing materials.
    - cement mortar
    - wiping solder and caulking lead

27. Interpret plumbing code requirements and define the requirements for miscellaneous materials.
    - brass floor flanges, screws, bolts, nuts and washers
    - cleanout fittings
    - mechanical couplings
    - saddle hubs

- supply and waste fittings
- shower valves
- direct flush valves
- drinking fountain bubblers
- back siphonage prevention
- relief valves
- reducing valves
- solar domestic hot water
- vent pipe flashing

CANADIAN PLUMBING CODE–JOINTS

28. Interpret plumbing code requirements and define the requirements for the construction and use of joints.
    - caulked lead drainage
    - wiped
    - screwed
    - soldered
    - flared
    - burned lead
    - mechanical
    - cold caulked

29. Interpret plumbing code requirements and define the requirements for joints and connections.
    - drilled and tapped
    - extracted tees
    - welded
    - unions/slip joints
    - increasers/reducers
    - burned lead
    - dissimilar metals
    - roof drain leader
    - floor outlet fixture
    - expansion and contraction
    - copper tube
    - indirect connections

30. Interpret plumbing code requirements and define the requirements for support of piping.
    - capability
    - independence
    - insulation
    - vertical piping
    - horizontal piping
    - underground horizontal

- above roof

31. Interpret plumbing code requirements and define the requirements for protection of piping.
    - backfilling
    - non-metallic
    - isolation from loads
    - frost and mechanical damage

32. Interpret plumbing code requirements and define the requirements for testing of drainage systems.
    - test and inspection
    - drainage systems
    - venting systems
    - water tests
    - air tests
    - final tests
    - ball tests

CANADIAN PLUMBING CODE–DRAINAGE SYSTEMS

33. Interpret plumbing code requirements and describe the procedures for providing and sizing connections to drainage systems.
    - sanitary drainage systems
    - overflows from rainwater tanks
    - direct connections

34. Interpret plumbing code requirements and describe the criteria for location of fixtures.
    - urinals restricted locations
    - upstream of interceptors
    - chemical storage locations

35. Interpret plumbing code requirements and describe the treatment of sewage and wastes.
    - sewage treatment
    - cooling of water or sewage
    - interceptors
    - neutralizing and dilution tanks

36. Interpret plumbing code requirements and describe the procedures for providing and sizing traps.
    - sanitary drainage systems
    - storm drainage systems
    - subsoil drainage pipe connections
    - building traps
    - trap seals

37. Interpret plumbing code requirements and describe the procedures for providing and sizing the arrangement of drainage piping.
    - separate systems
    - location of pipes
    - sumps or tanks
    - protection from back-flow
    - mobile home sewer service

38. Interpret plumbing code requirements and describe the procedures for locating and sizing clean-outs for.
    - drainage systems
    - sizing and spacing
    - manholes
    - locations

39. Interpret plumbing code requirements and describe the criteria for minimum slope and length of drainage pipes.
    - minimum slope and length of fixture outlet pipes

40. Interpret plumbing code requirements to determine the size of drainage pipes.
    - no reduction
    - serving water closets
    - fixture outlet pipes
    - size of building drain and building sewer

41. Interpret plumbing code requirements to determine hydraulic loads.
    - total load
    - for fixtures
    - continuous flow
    - roofs or paved surfaces
    - conversion to litres
    - soil or waste pipes
    - branches
    - building drains or sewers
    - roof gutters
    - storm or combined building drains or sewers
    - leaders

CANADIAN PLUMBING CODE–VENTING SYSTEMS

42. Interpret plumbing code requirements and describe the procedures for providing and sizing vent pipes for traps.

43. Interpret plumbing code requirements and describe single storey wet venting.
    - single storey wet venting
    - relief vents

44. Interpret plumbing code requirements and describe multi storey wet venting.

45. Interpret plumbing code requirements and describe the criteria for providing and sizing vent pipes for soil or waste stacks.
    - stack vent
    - vent stack
    - relief vent
    - relief vents for offsets

46. Interpret plumbing code requirements and describe the procedures for providing and sizing miscellaneous vent pipes.
    - sewage sumps
    - oil interceptors
    - corrosive piping/dilution tanks
    - fresh air inlets
    - future installations

47. Interpret plumbing code requirements and describe the arrangement of vent pipes.
    - drainage of vent pipes
    - vent pipe connections
    - connection above fixtures served
    - terminals

48. Interpret plumbing code requirements and describe the procedures for providing and sizing location of vent pipes.
    - fixture traps
    - trap arms
    - water closets

49. Interpret plumbing code requirements and describe the minimum size of vent pipes.
    - general applications
    - size restriction
    - relief vents
    - relief vents (more than 11 storeys)
    - manholes
    - sewage sumps
    - oil interceptors

50. Interpret plumbing code requirements and describe the sizing of vent pipes.
    - hydraulic loads to wet vents
    - individual vents and dual vents
    - branch vents, headers and continuous vents
    - vent stacks, stack vents or headers

51. Describe the procedures for installing the various commercial vent systems.
    - material lists
    - interference
    - locate and cut openings
    - installation/support
    - protection
    - testing and inspection

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- install acid waste piping.
- install sewage pumps.
- install interceptors.
- install indirect connections.

PLG-1135 Appliances, Fixtures & Trim 1 (Residential)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for Plumber tasks 19, 20, 35 & 36.

Description:

The course is designed to introduce plumbing fixtures, appliances and installation techniques for residential, commercial and industrial applications. Course material covers:

- fixtures and their applications
- common bathroom fixtures
- washing machines and laundry trays

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140,-1100, 1120

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- select, install plumbing fixtures, appliances and trim for a variety of residential applications

Required Knowledge and Skills:

COMMON BATHROOM FIXTURES AND TRIM

1. Describe common fixtures, their manufacture and characteristics.
   - importance of completing the job well
   - common fixtures
   - receiving and handling of fixtures
   - use of manufacturers' instructions

2. Describe the procedures used to install common bath and shower trim and/or accessories.
   - bath and shower
   - water supply and drainage connections
   - bath and shower trim

- shower heads

3. Describe the procedures used to install common types of lavatories.
   - wall hung lavatory
   - water supply and drainage connections
   - lavatory on concealed supports
   - counter top lavatory
   - lavatory fittings, trim and accessories

4. Describe the procedures used to install common types of water closets, bowls, trim and accessories including water supply and drainage connections.

5. Describe the procedures used to install shower stalls including water supply and drainage connections.

6. Describe the procedures used to install bidet and parts including water supply and drainage connections.

7. Identify and interpret the Canadian Plumbing Code Sections which apply to the application, installation and testing of common bathroom fixtures and trim.

KITCHEN SINKS AND ACCESSORIES

8. Identify and interpret sources of information and instructions.
   - drawings
   - specifications
   - manufacturer's literature

9. Describe the various types of sinks, their trim and accessories.

10. Describe procedures used for installation of kitchen sinks.
    - installation
    - drain connection

11. Describe the procedures used for installation of garbage disposer or garborator.
    - installation
    - drain connection
    - electrical connections (safety)

12. Describe the procedures used for installation of dishwashers.
    - cross connection prevention

13. Describe the procedures used for installation of hot water dispensers.

14. Identify and interpret the Canadian Plumbing Code Sections that apply to the application, installation and testing of kitchen sinks and accessories.

WASHING MACHINES AND LAUNDRY TRAYS

15. Identify and interpret sources of information for installation.
    - drawings
    - specifications
    - manufacturer's literature

16. Describe the various types of laundry trays and accessories, their characteristics and applications.

17. Describe the procedures used to install washing machines.
    - procedures
    - cross connections prevention
    - water supply connections
    - waste connections
    - check operating cycle

18. Identify and interpret the Canadian Plumbing Code sections that apply to the application, installation and testing of laundry trays and washing machines.

PLUMBING ACCESSORIES

19. Describe the various types of plumbing accessories, their characteristics and applications.
    - grab bars
    - soap dispenser
    - paper towel dispenser
    - toilet paper holder
    - towel shelves
    - towel pins
    - single and double hooks
    - soap holders and dishes
    - paraplegic equipment
    - shower curtain rods
    - shower doors

20. Describe procedures used to install the various types of plumbing accessories.

21. Identify and interpret the National Building Code of Canada, sections which apply to the requirements and installation of plumbing accessories.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- determine the size of water supply and drain or waste connections required for the above noted fixtures as per plumbing codes and manufacturers' literature.
- choose, locate and install plumbing fixtures with the aid of plumbing codes, building codes and manufacturers literature as directed by the instructor.

PLG-1140 Appliances, Fixtures & Trim 2 (Commercial)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber tasks 19, 20, 35 & 36. .

Description:

The course is designed to introduce plumbing fixtures, appliances and installation techniques for commercial applications. Course material covers:

- fixtures and their applications
- commercial appliances and fixtures

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140, PLG-1100, 1120, 1135

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- select, install plumbing fixtures, appliances and trim for a variety of commercial applications

Required Knowledge and Skills:

1. Describe the various types of fixture carriers, their parts, characteristics and applications.
   - water closet connection
   - urinal wall carrier
   - lavatory supports

2. Describe and identify the sources of information relevant to installation.
   - drawings
   - specifications
   - manufacturers' literature

3. Describe carriers for batteries of fixtures.
   - determination of left-hand and right-hand systems

4. Describe typical installations.
   - residential
   - commercial/industrial

5. Describe the various types of connections used for fixtures.
   - floor style back outlet closet connection
   - lead pipe connection
   - tapered thread connection
   - o-ring seal connection

6. Describe the procedures used to install the following:
   - water closet carriers
   - basin and sink carrier
   - urinal carrier

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- lay out, mark and install bolts, brackets or chair carriers for.
  - water closets
  - lavatories
  - urinals

PLG-1145 Appliances, Fixtures & Trim 3 (Commercial/Industrial)

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber tasks 19, 20, 35 & 36.

Description:

The course is designed to introduce plumbing appliances and installation techniques for commercial and industrial applications. Course material covers:

- fixtures and their application
- commercial appliances

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140, PLG-1100, 1120, 1135, 1140

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- select and install plumbing fixtures, appliances and trim for a variety of commercial/Industrial applications

Required Knowledge and Skills:

COMMERCIAL APPLIANCES

1. Identify and interpret sources of information for installation of appliances.
   - drawings
   - specifications
   - manufacturer's literature

2. Describe the various types of dishwashers, their operation and procedures used for installation.

3. Describe the various types of automatic clothes washers their operation and procedures used for installation.

4. Describe the various types of garbage disposal units their operation and procedures used for installation.

5. Describe the various types of water stations, their operation and procedures used for installation.

6. Describe potential cross connections and effective preventative measures.

7. Identify and interpret the Canadian Plumbing Code sections that apply to the application, installation and testing of commercial appliances.

INSTITUTIONAL AND INDUSTRIAL FIXTURES AND TRIM

8. Identify and interpret sources of information for installations.
   - drawings
   - specifications
   - manufacturers' literature

9. Describe institutional and industrial fixtures and their characteristics.
   - water closet (patients)
   - water closet (specimen)
   - lavatory (patients)
   - lavatory (exam/treatment)
   - lavatory (general)
   - bathtub
   - sitz bath
   - clinic service sink
   - surgeon's scrub sink
   - eye wash
   - emergency shower
   - plaster sink
   - vacuum breaker
   - bedpan cleanser
   - thermostatic mixing valve
   - pedal valve or stop
   - knee action mixing valve
   - shower head
   - bradley wash fountain
   - mop sinks
   - vandal proof fixtures and fittings
   - whirlpool bath

10. Describe procedures used to install institutional and industrial fixtures and trim.

11. Identify and interpret the National Building Code and Canadian Plumbing Code sections which apply to the installation and testing of institutional and industrial fixtures and trim.

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- classroom exercises as determined by the instructor.

PLG-1155 Rural Waste Disposal

NOA Reference:

The material covered satisfies in whole or in part, the requirements of the National Occupational Analysis for Plumber tasks 32, 33 & 34.

Description:

This course is designed to introduce septic tank systems used in rural areas for disposal of waste. Course material covers:
- equipment
- piping systems

Prerequisites:

PIP-0100, 1110, 1115, 1120, 1125, 1130, 1135, 1140, 1150, PLG-1100, 1120, 1125

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:
- describe the sizing, planning and installation of rural waste disposal systems

Required Knowledge and Skills:

SEPTIC TANKS AND DISPOSAL FIELDS

1. Describe some of the dangers of unregulated sewage and liquid-borne waste.
   - danger to health
   - transmission of communicable diseases
   - danger to wells and water sources
   - danger to aquatic and animal life

2. Describe the location of a septic tank.
   - house
   - well
   - property lines

3. Describe the procedures used to install a septic tank.
   - building drain height
   - depth in ground
   - set tank level
   - tank test
   - correct in and outlet
   - tank covering

4. Describe the design features of a septic tank.
   - size
   - materials liquid capacity
   - measurements
   - manholes
   - covers
   - tank extensions
   - tees
   - baffles
   - drop through tank

5. Describe the purpose and operation of a septic tank scum.

6. Describe the purpose and operation of a syphon or a lift pump in the septic tank.

7. Describe the purpose and components of an on-site sewage system.
   - tank
   - pipe
   - gravel
   - soil

8. Describe the elements of site evaluation.
   - lot size and dimensions
   - lot topography
   - water table
   - bedrock

9. Describe the textural properties of soils and their significance to rural waste disposal.
   - sandy gravel
   - silty sand
   - sandy silt
   - clay silt
   - silty clay
   - clay

10. Explain the evaluation of site conditions.
    - soil
        - texture
        - structure
        - depth
        - color
        - density
    - minimum clearances
        - wells
        - sub soil drain
        - watercourses

11. Describe the operation and loading rates for disposal field soils.
    - aerobic bacteria
    - anaerobic bacteria
    - soil types
    - maximum loading rates
    - soil permeability

12. Describe the types of materials used for disposal fields and the procedures used for installation.
    - pipe
    - fittings
    - grades
    - gravel
    - geotextile
    - sand
    - imported fill

13. Describe a C1 contour disposal field, its design and applications.
    - type of trench
    - area of trench
    - lower and upper limits
    - trickle and pressure system

14. Describe an area bed disposal field, its design and applications.
    - design layout
    - problems with breakout
    - capacity

15. Describe a multiple trench disposal system, its design and applications.
    - design layout
    - headers
    - gallons per day

16. Describe a leaching chamber disposal system, its design and applications.
    - purpose of concrete chambers
    - design layout
    - capacity

17. Describe a built-up mound disposal system, its design and applications.
    - depth of soil
    - physical layout
    - pump pressures

INSPECTION, MAINTENANCE & REGULATIONS

18. List the inspection points and describe procedures used for final inspection of the following:
    - public health notification
    - backfill
    - angles
    - pipe size
    - gravel
    - sand
    - grade
    - contents of final inspection report

19. Describe the care and maintenance of septic tanks and disposal systems.
    - foundation and roof drains
    - flushing non-decomposable items
    - septic tank additives
    - vehicle traffic
    - sod cover
    - checking tank
    - pumping tank

20. Describe potential problems with septic tanks and disposal systems and their remedies.
    - tank and pipe material
    - tank
    - rain water and subsoil water
    - chemicals
    - field depth
    - grade
    - earth cover

21. Describe the purpose and content of provincial regulations respecting on-site sewage disposal systems.
    - definitions
    - permits

- lot category
- clearances
- design specifications
- minor variation in building lot
- non-water carried toilet system
- manufacture of septic tank or other disposal system appurtenances
- licensing of installers
- licensing of septic tank cleaners
- percolation test procedure
- general regulations

22. Describe preventative maintenance of on-site sewage disposal system.
    - soil compacted by heavy machinery
    - scarifying the soil
    - backfilling
    - testing tanks and syphons
    - breakout
    - elevations
    - trench width

Suggested Learning Activities:

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include.

- classroom exercises as determined by the instructor.

PLG-1160 Specialty Plumbing Systems

NOA Reference:

The material covered satisfies in whole or in part, the requirements of National Occupational Analysis for Plumber task 28.

Description:

This training course introduces the principles and applications of specialty systems encountered in the piping trades. Course material covers:

- type of system
- associated piping
- code requirements
- installation procedures

Prerequisites:

PIP-0100, 1120, 1125, 1130, 1135, 1140, PLG-1100, 1120

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

- identity swimming pool applications
- demonstrate an understanding of the installation of swimming pool systems and equipment
- identity lawn sprinkler systems applications
- demonstrate an understanding of the installation of lawn sprinkler systems and equipment

Required Knowledge and Skills:

SWIMMING POOLS

1. Identify and interpret sources of information pertaining to installation.
   - drawings
   - specifications
   - manufacturers' literature

2. Describe a typical swimming pool installation, the component parts and operation.
   - piping
   - skimmer
   - hair and lint strainer
   - filter pump
   - circulating pump
   - filter
   - chlorinator
   - pool heater
   - controls

3. Describe skimmers, their location and operation.
   - residential installation
   - normal skimming operation
   - safety by-pass operation
   - skimmers and accessories

4. Describe hair and lint strainers, their location and operation.
   - typical types of hair and lint strainers
   - layout of plumbing

5. Describe types of filter systems, their location and operation.
   - operating principle
   - types of installations
   - cleaning the filter
   - two tank battery system
   - single tank systems
   - multiple-battery system

6. Describe types of filter pumps, their parts and operation.
   - typical types of filter pumps

7. Describe vacuum systems, their parts and operation.
   - directions for use

8. Describe methods of heating swimming pools.
   - gas
   - electric
   - solar
   - heat exchangers
   - heat pumps

9. Describe chlorinators, their purpose and operation.

10. Describe flowmeters, their purpose and operation.

11. Describe the procedures used to install swimming pool piping and accessories.

LAWN SPRINKLER SYSTEMS

12. Describe the component parts of a sprinkler system, their function and operation.
    - spray heads
    - draining points
    - valves
    - chemical fertilizer injectors
    - water supply connections

13. Identify and interpret sources of information pertaining to lawn sprinkler systems.
    - drawings
    - specifications
    - manufacturers' literature

14. Describe the types of pipes and fittings used in lawn sprinkler systems.

15. Describe potential dangers from cross connection and methods used to eliminate them.

16. Describe the procedures required to install lawn sprinkler systems.

Suggested Learning Activities.

Suggested learning activities are assigned to enhance the apprentice's ability to meet the objectives of the course. The learning activities outlined in this course are provided as suggestions only and may be substituted by the instructor for other relevant activities. Suggested learning activities include:

- classroom exercises as determined by the instructor.